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in the area of crop and animal protection
materials, strategies and methods.

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Section Editors: **J. Mike Hardman**
Dr. Bruce Neill

PMR REPORT # 001 SECTION A: INSECT PESTS OF FRUIT

CROP: Apple cv Red Delicious and McIntosh
PEST: European red mite (ERM), *Panonychus ulmi* (KOCH)

NAME AND AGENCY:
APPLEBY, M
Ontario Ministry of Agriculture, Food and Rural Affairs
R.R. #3, 95 Dundas Street, Brighton, Ontario K0K 1H0
Tel: (613) 475-1630 **Fax:** (613) 475-3835

TITLE: **COMPARISON OF SMOTHER-OIL TO OMITE IN CONTROL OF MITES DURING THE SUMMER**

MATERIAL: Omite 30W, Propargite, Smother-Oil, petroleum oil 80%

METHODS: A randomized complete block design replicated four times was conducted on a 0.5 ha block of apple trees. Three tree plots were used. These trees were planted in 1985 on M26 rootstock. Unsprayed guard trees were left between the plots to reduce spray drift. Treatments were applied to run-off using a hydraulic handgun on a Rittenhouse sprayer operating at 2700 kPa. Smother-Oil was sprayed on August 17 '95 at 2L product per 100 L water and Omite 30W 5.5 kg/ha.

The block was treated with a superior oil (60 L/ha) spray (green tip to 1/2 inch green) for control of overwintering ERM eggs. Appropriate fungicides and insecticides were applied as needed on an IPM program. Plots were treated with Omite and Smother-Oil on August 17, 1995 after the number of active mites exceeded 10 active mites per leaf.

Prespray counts, taken on a weekly basis, were estimated by counting the number of mites on 25 mid-shoot leaves from throughout the experimental area. On August 11 there was an average of 40.12 eggs, and 12.64 nymphs and adults per leaf on Red Delicious and an average of 6.88 eggs and 3.96 nymphs and adults per leaf on McIntosh. On August 17th, prior to treatment, and on August 25th, 8 days post treatments, 50 mid-shoot leaves per three tree plot was examined for mites. All leaves were checked under a binocular microscope. The plots were examined for phytotoxicity and one week and three weeks post application. Fruit was harvested and assessed for phytotoxicity as well.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: The Smother-Oil treatment on Red Delicious reduced the number of nymphs and adults compared to the unsprayed plots. The control was comparable to Omite treated plots which also reduced the number of nymphs and adults compared to the unsprayed check plots.Prespray counts on McIntosh were below threshold levels. Because it was the end of the season, McIntosh plots were treated with Omite and Smother-Oil. The Smother-Oil treatment on McIntosh did not reduce the nymphs and adults at 5% level of significance. There was a reduction of adults in Omite treated plots compared with the unsprayed check plots. No phytotoxicity was noticed on the leaves or fruit of Red Delicious and McIntosh trees.

Table 1. Effect of Smother Oil and Omite on mite numbers.

	Treatment	Eggs	Nymphs	Adults	Total No.
Red Delicious					
PRE-TREATMENT	Check	22.2 a[1]	1.2 a	2.3 a	25.6 a
August 17, 1995	Omite	28.4 a	1.0 a	1.8 a	31.1 a
	Smother-Oil	30.2 a	1.0 a	1.9 a	33.1 a
8 Days	Check	15.8 a	2.4 a	2.5 a	20.7 a
POST TREATMENT	Omite	6.7 a	0.5 b	0.3 b	7.4 a
August 25, 1995	Smother-Oil	7.4 a	0.5 b	0.4 b	8.2 a
McIntosh					
PRE-TREATMENT	Check	16.2 a	0.6 a	1.5 a	18.2 a
August 17, 1995	Omite	14.3 a	0.5 a	2.0 a	16.8 a
	Smother-Oil	17.8 a	1.1 a	1.4 a	14.2 a
8 DAYS	Check	14.6 a	0.9 a	2.8 a	18.3 a
POST TREATMENT	Omite	9.7 a	0.3 a	0.2 a	10.2 a
August 25, 1995	Smother-Oil	7.8 a	0.3 a	1.1 ab	9.1 a

[1] Means followed by the same letter in each column are not significantly different using Duncan's multiple range test (P = 0.05)

RAPPORT # 002 **SECTION A: INSECTES DES FRUITS**
IRAC #: 93000234

CULTURE: Pommier
RAVAGEUR: Charançon de la prune, *Conotrachelus nenuphar* Herbst.

NOM ET AGENCE:
CHOUINARD G et LAPLANTE G
Centre de recherche et d'expérimentation agricoles de Saint-Hyacinthe,
Ministère de l'agriculture, des pêcheries et de l'alimentation du Québec, 3300 rue Sicotte, C.P. 480, Saint-Hyacinthe, Québec, J2S 7B8
Tél.: (514) 778-6522 **Télécopieur**: (514) 778-6539
e-mail: Gerald.Chouinard@agr.gouv.qc.ca

TITRE: **DÉVELOPPEMENT D'UN OUTIL DE DÉPISTAGE DU CHARANÇON DE LA PRUNE EN VERGERS DE POMMIERS**

PRODUITS: piège de Tedder

MÉTHODES: Trois vergers de pommiers commerciaux de 1 à 5 ha ont été sélectionnés pour les essais qui se sont déroulés en 1995 et 1996. A l'intérieur de chaque verger, cinq secteurs ont été définis (nord, sud, est, ouest, centre). Dans chaque secteur, une méthode de dépistage des dégâts sur fruits a été comparée à deux méthodes de dépistage des adultes afin de vérifier leur performances respectives. La première méthode consistait à sélectionner au hasard 10 arbres, à observer deux fois par semaine la face exposée de 20 fruits sur chacun d'eux et à noter le nombre de dégâts de charançon observés. La deuxième méthode consistait à sélectionner au hasard 20 arbres, à effectuer deux fois par semaine un battage de 3 branches dans chacun d'eux, et à noter le nombre de charançons récoltés sur un carré de tissu de 1 X 1 m placé en dessous. La troisième méthode consistait à installer 1 piège dans chaque section à ca. 50-100 cm du tronc d'un arbre déterminé au hasard, et à effectuer le relevé des captures deux fois par semaine. Le dépistage a été effectué pendant 4 semaines, débutant au stade bouton rose avançé du pommier (environ à la fin mai).

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Dans la plupart des cas, les pièges ont représenté la méthode la plus rapide pour déceler les premiers signes d'activité du charançon de la prune dans les vergers. Les études se poursuivent cependant afin d'améliorer l'attractivité du piège et réduire ainsi le nombre de pièges pouvant être requis pour une utilisation sécuritaire et économique de la méthode.

Table 1.

Année:		1995						1996					
Verger:		1		2		3		1		2		3	
Traitements	n	J*	A*	J*	A*	J*	A*	J*	A*	J*	A*	J*	A*
Observation de fruits	1000	153	106	149	1260	171	9	159	24	152	483	159	94
Battage de branches	500	157	6	146	133	164	2	172	3	152	6	165	2
Piège de Tedder	4	143	26	152	32	164	6	152	4	149	16	152	14

* J:jour julien d'observation du premier signe d'activité (adultes ou dégâts)
* A:occurences totales d'activité (adultes ou dégâts) notées pendant la saison pour les 8 visites faites chaque année.

PMR REPORT # 003 **SECTION A: INSECTS OF FRUIT - Tree Fruit**
STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. McIntosh **PREDATOR:** *Typhlodromus pyri* (TP) Scheuten
PEST: European red mite (ERM), *Panonychus ulmi* (Koch)

NAME AND AGENCY:
HARDMAN, J. M.
Agriculture and Agri-Food Canada, Atlantic Food and Horticulture Research Centre, 32 Main Street, Kentville, Nova Scotia B4N 1J5
Tel: (902) 679-5729 **Fax:** (902) 679-2311 **Email:** hardmanm@em.agr.ca

TITLE: EFFECTS OF MATADOR ON CONTROL OF EUROPEAN RED MITE BY A PYRETHROID-RESISTANT STRAIN OF THE PREDATOR MITE *TYPHLODROMUS PYRI*

MATERIALS: MATADOR 50 EC (lambda-cyhalothrin) 6.7 mL product/100 L, MATADOR 120 CSO (lambda-cyhalothrin in cotton seed oil) 2.8 mL product/100 L, RIPCORD 400 EC (cypermethrin) 4.17 mL product/100 L.

METHODS: All trees tested in this trial had been inoculated the previous summer (25 August 1994) with 50-120 motile stages of a pyrethroid-resistant strain of *T. pyri* originally imported from New Zealand. Transfer was achieved by placing single shoots from *T. pyri*-occupied trees on the foliage of each treated and guard tree in the orchard block. Single-tree plots of 9 yr-old Summerland McIntosh trees on MM111 rootstocks were sprayed to runoff using a truck-mounted lance sprayer at 2800 kPa pressure and a volume of ca 18 L per tree. Eight trees were treated with MATADOR 50 EC and eight with MATADOR 120 CSO when trees were at the pink bud stage (25 May 1995). Four trees were treated with RIPCORD at calyx (12 June 1995) and four other trees were untreated controls. At least two guard trees within a row separated trees having different treatments. Pesticides were diluted to a rate comparable to 3000 litres/ha. A precount of ERM winter eggs was taken 11 May 1995 from the 16 trees that were later sprayed with the pyrethroids MATADOR 50 EC or MATADOR 120 CSO. Four 5.0 cm subterminal twigs were taken from each tree and examined for eggs under a binocular microscope. Samples of 25 leaves per tree were taken on the dates shown below and passed through a mite-brushing machine. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: Pretreatment counts of *P. ulmi* winter eggs were high, averaging 184 eggs /20 cm of wood, indicating the potential for explosive growth of *P. ulmi* unless they were suppressed by predators. There were some significant variations among summer eggs of *P. ulmi* in early summer (Table 1). However, treatment means for motile *P. ulmi* did not differ until mid-July and treatment means for *T. pyri* did not differ until early August. Motile *P. ulmi* reached highest counts in early August and then stabilized (MATADOR 120 CSO plots) or declined by mid-August due to increasing predation by *T. pyri*. The 1st-15th August decline of *P. ulmi* was strongest in the RIPCORD plot. By mid-August, populations of *T. pyri* in all plots were high enough to significantly affect *P. ulmi* counts despite previous applications of MATADOR or RIPCORD.

CONCLUSIONS: The pyrethroids MATADOR and RIPCORD were applied in early summer 1995 on trees heavily-infested with *P. ulmi* and at a time when *T. pyri* were just starting to get established on the trees. (Extensive research in Nova Scotia and elsewhere indicates *T. pyri* requires 1-2 years to get well enough established on trees to give effective control of *P. ulmi*). Nonetheless, by August 1995 predator populations were able to stabilize or reduce densities of *P. ulmi*. Thus the data suggests that RIPCORD and MATADOR are compatible with biological control of *P. ulmi* by pyrethroid-resistant *T. pyri*.

Table 1. Means for number of mites per leaf on 4-8 McIntosh apple trees per treatment. Means in the same column followed by the same letter are not different according to Tukey's Studentized range test after square root transformation of the data. Symbols: RME, RM- summer eggs and motile stages of *P. ulmi*; TP- motile stages of *T. pyri*.

	19 June			26 June		
Treatment	RME	RM	TP	RME	RM	TP
Control	10.80a	0.80b	0.00a	10.21ab	5.41a	0.10a
MATADOR 120 CSO	2.70b	0.30bc	0.00a	2.63b	0.71a	0.03a
MATADOR 50 EC	6.39ab	0.10c	0.08a	9.61ab	2.60a	0.08a
RIPCORD	15.00a	2.60a	0.00a	20.80a	6.40a	0.00a

	7 July			14 July		
Treatment	RME	RM	TP	RME	RM	TP
Control	10.21ab	5.42a	0.10a	14.96ab	3.17b	0.11a
MATADOR 120 CSO	2.23b	1.33a	0.05a	5.06bc	1.90b	0.05a
MATADOR 50 EC	7.39ab	8.00a	0.00a	2.90c	0.70b	0.03a
RIPCORD	20.80a	6.40a	0.00a	35.80a	13.00a	0.00a

	1 August			15 August		
Treatment	RME	RM	TP	RME	RM	TP
Control	65.80a	24.80a	1.80a	36.35ab	15.95ab	2.46a
MATADOR 120 CSO	42.70ab	22.10a	0.31b	45.31a	24.83ab	0.56b
MATADOR 50 EC	45.80ab	40.40a	0.21b	62.90a	31.70a	0.75b
RIPCORD	24.80b	31.80a	0.46ab	8.00b	2.80b	0.93ab

STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. McIntosh
PEST: European red mite (ERM), *Panonychus ulmi* (Koch)

PREDATOR: *Typhlodromus pyri* (TP) Scheuten

NAME AND AGENCY:
HARDMAN, J M
Agriculture and Agri-Food Canada, Atlantic Food and Horticulture Research Centre, 32 Main Street, Kentville, Nova Scotia B4N 1J5
Tel: (902) 679-5729 **Fax:** (902) 679-2311 **Email:** hardmanm@em.agr.ca

TITLE: ASSESSING EFFECTS OF PYRIDABEN ON EUROPEAN RED MITE AND THE PHYTOSEIID PREDATOR MITE *TYPHLODROMUS PYRI*

MATERIALS: SANMITE 75 WP (BASF 300 11 I, pyridaben) 9.6 g, 20.0 g, 96 g and 200 g product/100 L, SUPERIOR OIL 70 (acaricidal petroleum oil) 2.17 L/100 L, OMITE 30 WP (propargite) 225 g/100 L.

METHODS: Four single-tree plots of 9 yr-old Summerland McIntosh trees on MM111 rootstocks were sprayed to runoff using a truck-mounted lance sprayer at 2800 kPa pressure and a volume of ca 12.5 litres per tree. The 70 sec oil component of the SUPERIOR OIL + SANMITE treatment was applied at the tight cluster stage of tree development (21 May 1995), whereas the SANMITE itself (9.6 g/100 L) was applied 22 June at first cover. Other treatments were applied on the dates shown in Table 1. Pesticides were diluted to a rate comparable to 3000 litres/ha. A precount of ERM winter eggs was taken 11 May 1995. Four 5.0 cm subterminal twigs were taken from each tree and examined for eggs under a binocular microscope. Samples of 25 leaves per tree were taken on the dates shown below and passed through a mite-brushing machine. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factors of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: Pretreatment counts of *P. ulmi* winter eggs varied from 0.8 to 62 eggs per 20 cm wood (Table 1). However, analysis of covariance indicated that counts of winter eggs had no significant effect on *P. ulmi* mite-days and counts of *P. ulmi* eggs and motile stages. Hence all analyses reported here are the simple one way analysis of variance with treatment as the only factor (Tables 1 and 2). Mite-days, the product of the mean number of motile *P. ulmi* per leaf (see counts in Table 2) and intervals between sampling dates, give an indication of seasonal mite injury. Total mite-days were actually higher on the trees treated 25 May with 96 g SANMITE and those treated 13 July with OMITE than on the untreated control trees where *T. pyri* was the only curb on *P. ulmi* numbers. Mite-days for *T. pyri* give an indication of seasonal abundance of this predator. Total *T. pyri* mite-days were highest on the control trees followed by those trees which had received no acaricide until 13 July (see the last two means in Table 1).

Up until mid-July, trees that had not yet been treated with acaricide (control, trees sprayed with SANMITE & OMITE 13 July) had as many or more motile *P. ulmi* and motile *T. pyri* than the trees that had already been treated (Table 2). By August the highest counts of motile *P. ulmi* were in the trees treated 25 May with 96 g SANMITE, whereas the lowest *P. ulmi* counts were in the trees treated 22 June with lower rates of SANMITE (9.6 g or 20 g). Predator numbers in August were highest in the trees with most *P. ulmi*, even including the trees that had been treated 25 May with a high concentration (96 g) of SANMITE. Conversely, *T. pyri* counts were zero the whole season on the trees treated 25 May with 200 g SANMITE. The second lowest counts of *T. pyri* were on the trees treated 22 June with 20 g SANMITE.

CONCLUSIONS: *T. pyri* were able to keep motile *P. ulmi* at relatively low numbers in all plots, except where SANMITE was applied at a high enough concentration to strongly suppress the predator. The best combination of very low numbers of *P. ulmi* coupled with moderate numbers of *T. pyri* was achieved with a low rate (9.6 g) of SANMITE applied either alone or with SUPERIOR OIL 70. These treatments would be useful where predator populations are too low to suppress *P. ulmi*.

Table 1. Initial count of *P. ulmi* winter eggs 11 May 1995 and seasonal (19 June-15 August) accumulations of mite-days per leaf for *P. ulmi* and *T. pyri*. Means in the same column followed by the same letter are not different according to the Waller-Duncan k ratio t test after square root transformation of the data.

Treatment	Rate /100 L		Date applied	Winter eggs	Total mite-days per leaf *P. ulmi*	Total mite-days per leaf *T. pyri*
Control				1.8b	61.4cd	70.8a
SUPERIOR OIL	2.17	L	21/5	13.5ab	8.7d	9.1b
+ SANMITE	9.6	g	22/6			
SANMITE	96.0	g	25/5	62.3a	155.6a	5.0b
SANMITE	200.0	g	25/5	25.0ab	56.3cd	0.0b
SANMITE	9.6	g	22/6	1.0b	14.3d	8.1b
SANMITE	20.0	g	22/6	20.0ab	10.4d	2.6b
OMITE	225.0	g	13/7	7.8b	126.7ab	15.8b
SANMITE	9.6	g	13/7	0.8b	88.5bc	15.5b

Table 2. Means for number of mites per leaf on McIntosh apple trees treated on the dates and concentrations shown in Table 1. Means in the same column followed by the same letter are not different according to the Waller-Duncan k ratio t test after square root transformation of the data. Symbols: RME, RM- eggs and motile stages of *P. ulmi;* TP- motile stages of *T. pyri*. Treatments are SANMITE unless otherwise specified.

		19 June			26 June	
Treatment	RME	RM	TP	RME	RM	TP
Control	0.00c	0.00a	0.10a	0.20b	0.00b	0.41a
Oil/SANMITE	0.00c	0.00a	0.00a	0.00b	0.00b	0.00b
96 g May	0.20bc	0.00a	0.00a	0.40b	0.00b	0.00b
200 g May	0.00c	0.00a	0.00a	0.20b	0.00b	0.00b
9.6 g June	1.20ab	0.00a	0.10a	2.20ab	0.00b	0.10b
20 g June	1.80a	0.40a	0.10a	2.00ab	0.20ab	0.00b
OMITE July	1.20ab	0.20a	0.05a	4.58a	0.60a	0.05b
9.6 g July	1.80a	0.00a	0.00a	1.00b	0.00b	0.05b

		4 July			14 July	
Treatment	RME	RM	TP	RME	RM	TP
Control	1.00abc	0.40a	0.26a	2.62bc	1.60a	1.14a
Oil/SANMITE	0.60abc	0.20a	0.10ab	0.20d	0.00a	0.05bc
96 g May	0.38bc	0.20a	0.00b	0.80cd	0.00a	0.00c
200 g May	0.00c	0.00a	0.00b	1.20cd	0.20a	0.00c
9.6 g June	2.05ab	0.20a	0.00b	0.20d	0.00a	0.26bc
20 g June	0.80abc	0.00a	0.00b	0.60cd	0.20a	0.00c
OMITE July	2.40a	0.40a	0.00b	7.09a	1.22a	0.21bc
9.6 g July	0.40bc	1.00a	0.05b	4.00ab	1.60a	0.36b

PMR REPORT # 005 **SECTION A: INSECTS OF FRUIT - Tree fruit**

CROP: Apple, cv. Red Delicious, Golden Delicious, Spartan, McIntosh
PESTS: Fruittree leafroller, *Archips argyrospila* (Wlk.)
European leafroller, *Archips rosana* (L.)

NAME & AGENCY:
PHILIP, H G and LASHUK, L
B.C. Ministry of Agriculture, Fisheries & Food
200-1690 Powick Road, Kelowna, B.C. V1X 7G5
Tel:(604)861-7211 **Fax:**(604)861-7490 **Email:** hphilip@galaxy.gov.bc.ca

TITLE: COMPARATIVE EFFICACIES OF DIPEL WP, DIPEL DF AND NOVO 48B FOR CONTROL OF FRUITTREE AND EUROPEAN LEAFROLLER LARVAE IN APPLE

MATERIALS: *Bacillus thuringiensis* var. *kurstaki* (Btk) products Dipel WP (16,000 International Units of Potency (IUP)/mg), Dipel DF (32,000 IUP/mg), and Novo (formerly FORAY 48B) (10,600 IUP/mg); air-blast orchard sprayer.

METHODS: This field study was conducted near Kelowna, B.C. in three apple orchards (A, B, C) with similar sized trees (3- to 5-metre tall) and planting densities (300-850 trees/ha). Each Btk product was applied in single plots (0.2-1.2 ha) in each orchard using an air-blast orchard sprayer calibrated to deliver between 840 and 1235 L of spray mixture/ha. Application rates are shown in Table 1. Application dates and weather conditions on those dates were as follows:

Orchard A - May 23, max. T 19 C, calm, dry;
Orchard B - May 16, max. T 18 C, calm, 0.4 mm rain;
Orchard C - May 21 (WP & DF), max. T 19 C, calm, 0.6 mm rain;
May 26 (NOVO), max. T 26 C, calm, dry.

Orchard C received 13.4 mm of rain on May 22.

Leafroller egg hatch was complete at the time of treatment, corresponding to full bloom of McIntosh. 0, 7 and 11 trees were left as unsprayed checks in orchards A, B, and C, respectively. Between 6 and 8 days after treatment, all unsprayed trees and 12 trees in each treatment plot were examined for 5 minutes (2.5 minutes upper half, 2.5 minutes lower half) and the number of live leafroller larvae was recorded.

RESULTS: Table 1 shows the results of the treatments on the number of live leafroller larvae found after a 1 hour search in each plot 6-8 days post-treatment. Also shown is the % change in the number of larvae found per minute of search from that of the check trees. Grower cooperators found the DF formulation easier to handle than the WP, however the liquid NOVO was preferred over both dry formulations for ease of handling. There was no statistically significant difference between treatments in the number of live larvae found during a 1 hour search 6-8 days post-treament. The treatments reduced the number of live larvae found per minute of search between 75.8 and 84.7% from that of the check trees. An examination of 100 fruit (50:50 upper:lower canopy) on 10 trees/plot just prior to hand-thinning revealed an average of 1.1%, 1.53% and 0.96% leafroller feeding damage in the NOVO, DIPEL WP and DIPEL DF plots, respectively. A similar examination of 11 check trees in orchard C (check trees in orchard B had been sprayed with NOVO after larval density assessment) revealed 4.18% of the apples were damaged by leafroller larvae.

CONCLUSIONS: DIPEL DF provided somewhat better reduction of leafroller larvae and protection of fruit compared to DIPEL WP and NOVO.

Table 1. Mean number of live leafroller larvae found per treatment (1 h search) and % change in number of live larvae found per minute search from that found in check trees.

Treatment	Application rate/ha	Mean number of live larvae (±SE)	% change from check trees
DIPEL WP	3.35 kg	8.67 (3.00)	-75.8
NOVO	4.0 L	8.67 (3.00)	-75.8
DIPEL DF	1.6 kg	5.33 (3.00)	-84.7

PMR REPORT # 006 **SECTION A: INSECTS OF FRUIT - Tree Fruit**
STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh
PEST: Codling moth, *Cydia pomonella* (L)

NAME AND AGENCY:
SMITH R F, Rigby S, and O'Flaherty C.
Agriculture and Agri-Food Canada, Atlantic Food & Horticulture Research Centre, 32 Mai
St., Kentville, Nova Scotia, B4N 1J5
Tel: (902) 679-5730 **Fax:** (902) 679-2311 **Email:** SmithR@em.agr.ca

TITLE: **EFFICACY OF RH-2485 80W AGAINST CODLING MOTH IN NOVA SCOTIA ORCHARDS**

MATERIALS: RH-2485 W(unknown)IMIDAN 50W (phosmet, Latron B-1956 spreader/sticker.

METHODS: The test site was a 2.0 ha block of six year old apple, cv. McIntosh at the Atlantic Food & Horticulture Research Centre, Kentville, Nova Scotia.
Using a sex pheromone baited trap, at 'biofix' of first moth capture, a heat unit accumulation was initiated and on July 17th 250 Degree-day heat units had accumulated indicating ca 3% codling moth egg hatch had occurred thus setting the timing of needed control measures. A Rittenhouse orchard mist sprayer delivering a 5x concentration of pesticide at a tank pressure of 1380 kPa was used to treat blocks of ca. 1/4 ha each with one rate of the following pesticides: IMIDAN 50 WP 1.0 kg product, RH-2485 240 g ai/ha with 0.12% (v/v) LANTRON spreader sticker added. An additional 1/4 ha was left unsprayed and served as a check plot.

On September 15th fruit injury was assessed by randomly examining 100 fruit on ten trees in each plot. Data was subjected to analysis of variance and separation of th means by Least Significant Difference tests.

RESULTS: Codling moth damage levels ranged from a low of 5.1% in the RH2485 plot to a high of 16.6% in the insecticide-free check plot.

CONCLUSIONS: A single application of RH2485 W gave protection of the fruit from codling moth attack, equilivant to the conventional pesticide IMIDAN. Both treatments were better than the unsprayed check.

Table 1. Comparison of injury levels of apples protected for codling moth damage by one application of RH2485W or IMIDAN.

Treatment	Rate ai per ha	Percent fruit damaged Mean	(SEM)*
Unsprayed Check	-	18.6	(3.42)a
IMIDAN 50WP	500g	8.1	(1.56)b
RH2485W +	240g		
LANTRON B-1956	360mL (product)	5.1	(1.36)b

* Means within a column sharing a common letter are not significantly different P=0.05 according to Least Significant Difference Tests (SAS 1995).

PMR REPORT # 007 **SECTION A: INSECTS OF FRUIT - Tree Fruit**
STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh
PEST: Codling moth, *Cydia pomonella* (L)

NAME AND AGENCY:
SMITH R F, RIGBY, S.and O'FLAHERTY, C.
Agriculture and Agri-Food Canada, Atlantic Food & Horticulture Research Centre, 32 Main St., Kentville, Nova Scotia, B4N 1J5
Tel: (902) 679-5730 **Fax:** (902) 679-2311 **Email:** SmithR@em.agr.ca

TITLE: **COMPARATIVE EFFICACY OF CONFIRM 240F (TEBUFENOZIDE) WITH AND WITHOUT SPREADER/STICKERS AGAINST CODLING MOTH IN NOVA SCOTIA ORCHARDS**

MATERIALS: CONFIRM 240F (tebufenozide), COMPANION spreader/sticker.

METHODS: The test site was a 1.5 ha block of thirty-five year old apple, cv. McIntosh a the Kentville Research Centre, Kentville, Nova Scotia. Using a sex pheromone baited trap, at 'biofix' of first moth capture, a heat unit (base 10 C) accumulation was initiated and on July 15th 250 Degree-day heat units had accumulated indicating ca 3% codling moth egg hatch had occurred thus setting the timing of needed control measures. A Rittenhouse orchard mist sprayer delivering a 5x concentration of pesticide at a tank pressure of 1380 kPa was used to treat with either: CONFIRM 240F at 240 g ai/ha alone i ca 0.5ha while another 0.5 ha portion of the orchard received CONFIRM 240F with a 0.1% (v/v) COMPANION spreader sticker. A additional 0.5 ha portion of adjacent orchard received no pesticide to control codling moth and served as a check plot.

On September 1st fruit injury was assessed by randomly examining 100 fruit on each of ten trees within each plot. Data was analysed by analysis of variance (ANOVA) and separation of the means by the Least Significant Different test.

RESULTS: Damage levels ranged from a low of 0.20% in the CONFIRM with spreader sticker plot to a high of 3.5% in the untreated check plot.

CONCLUSIONS: The addition of COMPANION spreader/sticker did not improve the efficacy of CONFIRM 240F. Both treatments gave fully satisfactory fruit protection from codling mot with less than 1% crop loss due to this pest.

Table 1. Comparison of injury levels of apples protected for codling moth damage by one application of CONFIRM without a spreader/Sticker or CONFIRM in combination with COMPANION spreader/sticker.

Treatment	Rate ai per ha	Percent fruit damaged Mean	(SEM)*
Unsprayed check	-	3.50	(0.5)a
CONFIRM without spreader	240g	0.90	(0.28)b
CONFIRM with spreader	240g	0.20	(0.13)b

* Means within a column sharing a common letter are not significantly different P=0.05, according to Tukey's pairwise comparison.

PMR REPORT # 008 **SECTION A: INSECTS OF FRUIT - Tree Fruit**
STUDY BASE #92007

CROP: Nectarines, cv. Harblaze
PESTS: Western flower thrips, *Frankliniella occidentalis* (Pergrande); green peach aphid, *Myzus persicae* (Sulzer)

NAME AND AGENCY:
HOGUE E J and SMIRLE M J
Pacific Agri-Food Research Centre, Agriculture & Agri-Food Canada,
Summerland, B.C. V0H 1Z0
Tel: (250) 494-7711 **Fax**: (250) 494-0835**Email**: SMIRLEM@EM.AGR.CA

TITLE: IMIDACLOPRID FOR CONTROL OF THRIPS AND APHIDS ON NECTARINES

MATERIAL: Imidacloprid (ADMIRE), 21.4% flowable

METHODS: The trial was conducted in a 0.4 ha block of nectarines, cv. Harblaze, that wa planted in 1991 and trained as open-centre trees. Treatment was applied April 26, 1996, two days after full bloom. Trees had received a dormant oil treatment on April 17. Imidacloprid was applied by hand-gun (sunset, temp. 13 degrees C., wind 5-8 Kph) in enough volume to thoroughly wet the foliage, but not to run-off, approximately 1 litre per tree.

For damage assessment, six check trees and three treatment trees were selected at random from the interior of the block, and an additional three treatment trees were selected from a guard row. The guard row trees were adjacent to wild lands with many early season flowering plants. At the time of full bloom in the nectarines, *Balsamorhiz sagittata* was in bloom and each flower contained many thrips. Examination of nectarine blossoms at time of treatment showed that approximately 50% contained thrips.

Damage was assessed on June 17-18. Fruit from regularly scheduled commercial thinning was collected and graded into 3 categories. **Clean**: no blemishes, scars, fruit deformation or bumps; **slight damage**: no scars or fruit deformation, but some minor blemishes and/or bumps (as fruit increases in size, most of these will disappear or be masked by coloration); **severe damage**: clearly non-marketable because of insect damage.

RESULTS: Results of the damage assessment are presented in Table 1. It is difficult to assess what proportion of fruit damage was caused by thrips and what proportion by aphids, but it appears that both contribute in varying degrees. Thrips damage was heavier in trees close to the wild lands, whereas aphid populations were variable throughout the block. No aphids were detected on any trees at treatment time, but examination of the trees one week after treatment showed that some control trees had a few aphids. No aphicides or other insecticides were applied until after thinning, when aphid populations on some trees were very high.

Time spent thinning damaged fruit in trees treated with imidacloprid was much less compared with control trees. Treated trees were clearly less affected by insects.

Table 1. Thrips and aphid damage on imidacloprid-treated and untreated nectarines.

Treatment	Tree No.	Damage assessment			
		Clean	Slight	Severe	Total Fruit
Check	1	4	16	200	220
	2	4	21	239	264
	3	4	32	217	253
	4	4	36	163	203
	5	83	54	165	302
	6	48	66	178	293
TOTAL		147	225	1162	1534
% of Total		9.6	14.7	75.7	
ADMIRE	1	105	39	11	155
	2	183	64	6	253
	3	309	61	10	380
	4	108	39	7	154
	5	268	29	6	303
	6	181	46	7	234
TOTAL		1154	278	47	1479
% of Total		78.0	18.8	3.2	

PMR REPORT # 009 **SECTION A: INSECTS OF FRUITS**
STUDY DATA BASE: 9207

CROP: Pears cv. Bartlett/ Anjou mix
PEST: Tentiform leafminer *Phyllonorycter mespilella*

NAME AND AGENCY:
COSSENTINE J E[a], JENSEN L B[a], and PHILIP H G[b]
[a]Agriculture and Agri-food Canada, Pacific Agri-Food Research Centre,
Summerland, B.C. V0H 1Z0 **Tel**: (250) 494-7711 **Fax**: (250) 494-0755
Email: COSSENTINE@BCRSSU.AGR.CA, JENSENLB@BCRSSU.AGR.CA
[b]British Columbia Ministry of Agriculture Fisheries and Food, Kelowna, B.C.
Tel: (250) 861-7211 **Fax**: (250) 861-7490
Email: HPHILIP@GALAXY.GOV.BC.CA

TITLE: EFFECT OF SPINOSAD ON TENTIFORM LEAFMINER (*PHYLLONORYCTER MESPILELLA*) MORTALITY AND PARASITISM

MATERIALS: Spinosad (NAF85) (DowElanco, Canada)

METHODS: Spinosad, a preparation of lactones from the *bacterium* Saccharopolyspora spinosa, was applied at concentrations of 50 and 100 ppm using an air-blast sprayer to blocks of 10 pear trees. An additional 10 untreated trees were used as controls. The trial was replicated twice over the orchard area with buffer rows between treatments. Treatments were made August 1, 1996 when 35.7 to 47.4% of the leafminers were found to be in the tissuefeeder stage of their second generation. Fourteen and 28 days posttreatment, 200 leaves were sampled at random through all trees in each treatment. Total leafminer counts, mortality, stage and presence of an ectoparasitoid (*Pnigalio flavipes* and/or *Sympiesis marylandensis*) were assessed.

RESULTS: The cause of *P. mespilella* mortality is difficult to determine as two indigenous ectoparasitoids host feed, often killing without leaving a feeding scar (ie. prespray sap- and tissuefeeder mortality of 8.1 to 49.8%, Table 1). Therefore, the influence of spinosad should be judged in relation to control mortality at each stage.

By day 14, spinosad treatments of both 50 and 100 ppm had caused significantly ($P<0.05$) higher mortality of both sapfeeders and tissuefeeders, and the 100 ppm, signficantly ($P<0.05$) higher pupal mortality, than was assessed in control blocks. Consequently, significantly ($P<0.05$) lower percentages of sapfeeders and tissuefeeders were found alive in the two treatment blocks versus the control. By day 28, the spinosad treatments were not showing a significant effect on mortality in any stage, however mortality was very high (ie. 75.9 - 98.1%) even in the control blocks (perhaps highly influenced by parasitism).

Spinosad did have a significant ($P<0.05$) negative effect on parasitism at both the sap and tissuefeeding stages 14 days posttreatment (Table 1). Parasitism at the pupal stage was significantly ($P<0.05$) higher in the two treatment blocks at day 14. By day 28, this positive influence on parasitism in the pupal stage was reversed.

CONCLUSION: Spinosad caused signficant mortality of both sap- and tissuefeeding stages of *P. mespilella* development. The treatments decreased, however did not eliminate, parasitism.

Table 1. Mean % tentiform leafminers alive, dead or parasitized within the sap-, tissuefeeder or pupal stages on pear, after treatment with 0, 50 or 100 ppm spinosad. Assessments made one day pretreatment and 14 and 28 days posttreatment.

	Pretrt			14 d posttrt			28 d posttrt		
	0	50ppm	100ppm	0	50ppm	100ppm	0	50ppm	100ppm
Sapfeeders									
% alive	54.7a*	54.0a	47.1a	9.9a	0.0b	0.0b	1.9a	0.0a	0.0a
% dead	40.7a	42.1a	49.8a	80.2a	100.0b	100.0b	98.1a	100.0a	100.0a
% par'd	4.6a	3.9a	3.0a	9.9a	0.0b	0.0b	0.0a	0.0a	0.0a
Tissuefeeders									
% alive	57.6a	40.1a	54.7a	30.2a	10.6b	0.0c	0.0a	0.0a	0.0a
% dead	15.2a	30.3a	8.1a	17.8a	78.9b	100.0c	75.9a	90.2a	97.7a
% par'd	27.3a	29.6a	37.3a	52.0a	10.6b	0.0c	24.1a	9.8a	2.2a
Pupae									
% alive	100.0a	100.0a	100.0a	93.1a	76.3a	71.8a	49.0a	93.8b	84.7a
% dead	0.0a	0.0a	0.0a	0.0a	0.0a	5.9b	4.2a	0.0a	9.7a
% par'd	0.0a	0.0a	0.0a	6.9a	23.6b	22.3b	46.9a	6.3b	5.6b

* means within survey date, leafminer stage and state (alive, dead or parasitized) followed by the same letter are not significantly ($p>0.05$) different as determined by Student's t-test.

REPORT # 010 **SECTION A: INSECTS OF FRUIT - BERRY CROPS**
STUDY DATABASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Thiessen, Smoky
PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

NAME AND AGENCY:

NEILL G B, REYNARD D A and CARPENTER L
Agriculture Canada, P.F.R.A., Shelterbelt Centre, Indian Head, Saskatchewan
S0G 2K0 **Tel**: (306) 695-2284 **Fax**: (306) 695-2568 **E-mail**: pf21801@em.agr.ca
HARRIS J L
Saskatchewan Agriculture and Food, Sustainable Production Branch, Regina,
Saskatchewan S4S 0B1 **Tel**: (306) 787-4669 **Fax**: (306) 787-0428

TITLE: **EVALUATION OF DATES OF APPLICATION OF ADMIRE AND ORTHENE FOR CONTROL OF WOOLLY ELM APHID ON ROOTS OF SASKATOON BERRY SEEDLINGS USING TWO APPLICATION METHODS AT TWO SITES IN SASKATCHEWAN**

MATERIALS: ADMIRE 24FL (imidacloprid), ORTHENE 75WP (acephate)

METHODS: The woolly elm aphid (WEA) is a serious pest of roots of saskatoon plants. ADMIRE and ORTHENE were applied by soil probe injection or drip irrigation to the roots of saskatoon seedlings at Lumsden (Site 1) and Sintaluta (Site 2), Saskatchewan on one of three dates from early to late July, 1996. ADMIRE was applied at a rate of 0.125 mL product/plant and ORTHENE at 0.65 g product/plant. WATER CHECKS were applied for each method of application on each date. Each site was a U-Pick orchard with rows spaced 3 m apart and an in-row spacing of 1 m. At Site 1, 10 reps were 2-year old 'Thiessen'. At Site 2, 6 reps were 2-year old 'Smoky' and 4 reps were 2-year old 'Thiessen'. The soil at Site 1 was a heavy clay and at Site 2 was a clay loam. Eighteen treatments were tested at each site in a randomized complete block design with single plant plots and 10 replications per site. Treatment dates were July 3, 16 and 30 at Site 1 and July 2, 15 and 29 at Site 2. Treatment dates will be referred to as Early, Mid and Late. Cumulative trap counts of 25%, 50%, 75% and 100% for alate WEA at Indian Head in 1996 occurred on June 28, June 28, July 1 and July 14, respectively. The Early treatment was therefore after about 75% of the WEA had migrated from elm to saskatoon whereas the Mid and Late treatments were applied after all WEA should have completed migration to saskatoons.

Soil probe injection was accomplished by using a CO2 pressurized backpack sprayer (R&D Sprayer Inc., Model D-201S) equipped with a modified handgun that had a shop built soil probe instead of a spray nozzle. The probe was constructed of a 10 mm diameter hollow metal pipe with a pointed end and a slit cut along one side of the pipe about 2 cm from the tip. At 250 kPa, about 2 L/min of fluid flowed through the slit in a 90 degree fan pattern. The probe was pushed into the soil to a depth of about 12 cm, with 3 to 5 probes made around each seedling at a distance of about 15 cm from the main stem. Two litres of solution was delivered to each seedling using the soil probe injector.

Drip treatments were applied using an apparatus that simulated a drip irrigation system. The apparatus consisted of a 20 L pail placed on a 33 cm x 33 cm x 28 cm frame. An emitter in the bottom of the pail allowed the solution to flow at a rate of 5 L/hour through a spaghetti line to the base of a single plant. Ten litres of solution was applied to each plant. Dikes of soil were formed around each seedling to allow for soil saturation.

A visual estimate of phytotoxicity was made by examining each plant and estimating the percentage of leaves that exhibited yellowing or browning. Phytotoxicity ratings and root infestation measurements were taken on August 23 and 30 at Site 1 and 2, respectively. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semicircle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 20 cm radius of the main shoots were assessed. The length of infested root was measured and later converted to an infestation class (0-4) as shown in table 1. Factorial analysis was conducted for two sites, with two insecticides, two methods of application on three dates. A square root (x + 0.5) transformation was conducted on root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: No phytotoxic damage was noted for saskatoon seedlings treated with ADMIRE or ORTHENE at either site.

WEA infested 33.3% and 63.3% of the CHECK plants at Sites 1 and 2, respectively for an overall mean of 48.3% (table 2). Infestation ratings were 0.93 and 2.10 for the CHECK plants at Sites 1 and 2, respectively for an overall mean of 1.52 (table 3). The infestation rating for water injected CHECK plants was 1.15 which was significantly less than the rating of 1.88 for the water drip CHECK plants (table 3). It is assumed that the physical action of injecting water near the roots may have caused some WEA mortality.

WEA infested 8.3% of the ADMIRE treated plants for a mean infestation rating of 0.24 (tables 2 and 3). The rating was significantly less than the CHECK. When ADMIRE was applied with the injection or drip methods, 6.7% and 10.0% of the plants were infested with WEA, respectively (table 4) for a rating of 0.20 and 0.28, respectively (table 5).

WEA infested 8.3% of the ORTHENE treated plants for a mean infestation rating of 0.13 (tables 2 and 3). The rating was significantly less than the CHECK but not different from ADMIRE. When ORTHENE was applied with the injection or drip methods, 5.0% and 11.7% of the plants were infested with WEA, respectively (table 4) for a rating of 0.08 and 0.18, respectively (table 5).

The date of application had a significant affect on infestation ratings when data from ADMIRE and ORTHENE were combined (table 5). The rating for Early, Mid and Late application was 0.06, 0.14 and 0.36, respectively. The Early and Mid application dates had a significantly lower infestation rate than the Late application date. The method of insecticide application did not have a significant affect on infestation ratings, but there was a significant interaction between date of application and method of application. The performance of the insecticides when injected was not affected by date of application, but when applied by drip, the performance was very good for early and mid application dates, but poor for the late application date. The WEA were small and just establishing on the roots at the time the Early and Mid applications were done. It appears that the WEA was more easily controlled during this Early and Mid period. The poorer performance of the drip application method during the Late treatment period may be because the established WEA were less affected by the drip solution which was much less concentrated than the injection solution with no direct placement of the solution near the roots.

CONCLUSIONS: No phytotoxic damage was noted for saskatoon seedlings treated with ADMIRE or ORTHENE. ADMIRE at 0.125 mL product per plant and ORTHENE at

0.65 g product per plant applied by soil probe injection or drip application were effective in reducing infestations by WEA on non-fruit bearing saskatoon seedlings. Treatment in early and mid July was more effective than late July when ADMIRE or ORTHENE were applied by drip irrigation.

Table 1. Woolly elm aphid infestation ratings used for evaluation of products on saskatoon plants in 1996.

Infestation rating	cm of aphid infested roots
0	0
1	1-3
2	4-7
3	8-14
4	15+

Table 2. Percentage of saskatoon plants infested with woolly elm aphid following ADMIRE, ORTHENE or WATER application on one of three dates and two application methods at two locations in Saskatchewan in 1996.

			Percent infested with WEA *						
			Site 1		Site 2		Mean		
Treatment	Rate (product /plant)	Application date**	Inj	Drip	Inj	Drip	Inj	Drip	Mean
ADMIRE	0.125 mL	Early	0	0	10	0	5.0	0.0	2.5
ADMIRE	0.125 mL	Mid	10	0	10	0	10.0	0.0	5.0
ADMIRE	0.125 mL	Late	0	30	10	30	5.0	30.0	17.5
Mean			3.3	10.0	10.0	10.0	6.7	10.0	8.3
ORTHENE	0.65 g	Early	0	0	10	0	5.0	0.0	2.5
ORTHENE	0.65 g	Mid	10	10	0	10	5.0	10.0	7.5
ORTHENE	0.65 g	Late	0	10	10	40	5.0	25.0	15.0
Mean			3.3	6.7	6.7	16.7	5.0	11.7	8.3
WATER CHECK	-	Early	20	40	60	70	40.0	55.0	47.5
WATER CHECK	-	Mid	30	50	30	90	30.0	70.0	50.0
WATER CHECK	-	Late	30	30	60	70	45.0	50.0	47.5
Mean			26.7	40.0	50.0	76.7	38.3	58.3	48.3
Site mean (CHECK)			33.3		63.3				
Mean			11.1	18.9	22.2	34.5	16.7	26.7	21.6

* Inj = Soil injection with 2 L of solution; Drip = Drip application with 10 L of solution.

** Early = July 2,3; Mid = July 15,16; Late = July 29,30.

Table 3. Infestation ratings for woolly elm aphid on saskatoon seedlings treated with ADMIRE, ORTHENE or WATER applied on one of three dates and two application methods at two locations in Saskatchewan in 1996.

			Aphid infestation rating*,**,***						
			Site 1		Site 2		Mean		
Treatment	Rate (product /plant)	Application date****	Inj	Drip	Inj	Drip	Inj	Drip	Mean
ADMIRE	0.125 mL	Early	0.00	0.00	0.30	0.00	0.15	0.00	0.08
ADMIRE	0.125 mL	Mid	0.30	0.00	0.20	0.00	0.25	0.00	0.13
ADMIRE	0.125 mL	Late	0.00	0.70	0.40	1.00	0.20	0.85	0.53
Mean			0.10	0.23	0.30	0.33	0.20	0.28	0.24 B
ORTHENE	0.65 g	Early	0.00	0.00	0.20	0.00	0.10	0.00	0.05
ORTHENE	0.65 g	Mid	0.20	0.20	0.00	0.20	0.10	0.20	0.15
ORTHENE	0.65 g	Late	0.00	0.10	0.10	0.60	0.05	0.35	0.20
Mean			0.07	0.10	0.10	0.27	0.08	0.18	0.13 B
WATER CHECK	-	Early	0.70	1.20	2.00	2.60	1.35	1.90	1.63
WATER CHECK	-	Mid	0.90	1.30	0.90	2.90	0.90	2.10	1.50
WATER CHECK	-	Late	0.60	0.90	1.80	2.40	1.20	1.65	1.43
Mean			0.73	1.13	1.57	2.63	1.15b	1.88a	1.52 A
Site mean (CHECK)			0.93 b		2.10 a				
Mean			0.30	0.49	0.66	1.08	0.48b	0.78a	0.63

* See Table 1 for explanation of rating.

** Inj = Soil injection with 2 L of solution; Drip = Drip application with 10 L of solution.

*** Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

**** Early = July 2,3; Mid = July 15,16; Late = July 29,30.

Table 4. Percentage of saskatoon plants infested with woolly elm aphid following ADMIRE or ORTHENE application on one of three dates with two methods of application for two locations in Saskatchewan in 1996.

	Percent infested with WEA *						
Application date**	ADMIRE		ORTHENE		Mean		
	Inject	Drip	Inject	Drip	Inject	Drip	Mean
Early	5.0	0.0	5.0	0.0	5.0	0.0	2.5
Mid	10.0	0.0	5.0	10.0	7.5	5.0	6.3
Late	5.0	30.0	5.0	25.0	5.0	27.5	16.3
Mean	6.7	10.0	5.0	11.7	5.8	10.8	8.3

* Inject = Soil injection with 2 L of solution; Drip = Drip application with 10 L of solution.

** Early = July 2,3; Mid = July 15,16; Late = July 29,30.

Table 5. Infestation ratings for woolly elm aphid on saskatoon seedlings treated with ADMIRE or ORTHENE applied on one of three dates and two application methods combining data from two locations in Saskatchewan in 1996.

	Aphid infestation rating*,**,***						
Application date****	ADMIRE		ORTHENE		Mean		
	Inject	Drip	Inject	Drip	Inject	Drip	Mean
Early	0.15	0.00	0.10	0.00	0.13	0.00	0.06 B
Mid	0.25	0.00	0.10	0.20	0.18	0.10	0.14 B
Late	0.20	0.85	0.05	0.35	0.13	0.60	0.36 A
Mean	0.20	0.28	0.08	0.18	0.14a	0.23a	0.19

* See Table 1 for explanation of rating.

** Inject = Soil injection with 2 L of solution; Drip = Drip application with 10 L of solution.

*** Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

**** Early = July 2,3; Mid = July 15,16; Late = July 29,30.

REPORT # 011 **SECTION A: INSECTS OF FRUIT - Berry crops**
STUDY DATABASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Martin, Smoky, Thiessen
PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

NAME AND AGENCY:
NEILL G B, REYNARD D A and CARPENTER L
Agriculture Canada, P.F.R.A., Shelterbelt Centre, Indian Head, Saskatchewan
S0G 2K0 **Tel:** (306) 695-2284 **Fax:** (306) 695-2568 **E-mail:** pf21801@em.agr.ca
HARRIS J L
Saskatchewan Agriculture and Food, Sustainable Production Branch, Regina,
Saskatchewan S4S 0B1 **Tel:** (306) 787-4669 **Fax:** (306) 787-0428

TITLE: **EVALUATION OF VARIOUS RATES OF ADMIRE AND ORTHENE FOR CONTROL OF WOOLLY ELM APHID ON ROOTS OF SASKATOON BERRY SEEDLINGS USING FOUR APPLICATION METHODS AT THREE SITES IN SASKATCHEWAN**

MATERIALS: ADMIRE 24FL (imidacloprid), ORTHENE 75WP (acephate).

METHODS: The woolly elm aphid (WEA) is a serious pest of roots of saskatoon plants. Two insecticides were evaluated at three sites in 1996 (Site 1 = Marquis, SK; Site 2 = Grandora, SK; Site 3 = Grand Coulee, SK). Twenty three treatments were tested at each site in a randomized complete block design with single plant plots and 10 replications per site. ADMIRE was tested at two rates (0.063 or 0.125 mL product/plant) and ORTHENE was tested at 3 rates (0.65, 1.10 or 1.70 g product/plant). Four methods of application were tested for each rate of insecticide. The methods were: injection of 1 L of solution with a soil probe, injection of 2 L of solution with a soil probe, soil drench of 2 L of solution using a metal can, or application of 10 L of solution using a drip applicator. WATER CHECKS were included for three methods of application (2 L soil injection, 2 L soil drench, 10 L drip application).

Soil injection was accomplished by using a CO2 pressurized backpack sprayer (R&D Sprayer Inc., Model D-201S) equipped with a modified handgun that had a shop built soil probe instead of a spray nozzle. The probe was constructed of a 10 mm diameter hollow metal pipe with a pointed end and a slit cut along one side of the pipe about 2 cm from the tip. At 250 kPa, about 2 L/min of fluid flowed through the slit in a 90 degree fan pattern. The probe was pushed into the soil to a depth of about 12 cm, with 3 to 5 probes made around each seedling at a distance of about 15 cm from the main stem. Either one or two litres of solution was delivered to each seedling using the soil injector.

Soil drench treatments were applied using a open ended 3.2 L can (15.2 cm diameter x 17.5 cm high). The can was placed over the seedling and soil was packed around the outside of the can to hold the solution. Two litres of solution was applied to each seedling.

Drip treatments were applied using an apparatus that simulated a drip irrigation system. The apparatus consisted of a 20 L pail placed on a 33 cm x 33 cm x 28 cm frame. An emitter in the bottom of the pail allowed the solution to flow at a rate of 5 L/hour through a spaghetti line to the base of a single plant. Ten litres of solution was applied to each plant. Dikes of soil were formed around each seedling to hold the solution and allow for soil saturation.

Each site was a U-Pick orchard with rows spaced 3 m apart and had an in-row spacing of 1 m. Saskatoon plants at all locations were 2 years old. At Site 1 (Marquis), all 10 reps were the variety 'Martin'. At Site 2 (Grandora), all 10 reps were 'Thiessen'. At Site 3 (Grand Coulee), 6 reps were 'Thiessen' and 4 reps were 'Smoky'. Sites 1 and 3 were clay loam soils while Site 2 was a sandy loam. Treatments were applied to non-fruit bearing plants after aphid migration from elm to saskatoon was completed and after general berry harvest. Treatment dates for Sites 1 to 3 were July 31, 26 and 24, respectively.

A visual estimate of phytotoxicity was made by examining each plant and estimating the percentage of leaves that exhibited yellowing or browning. Phytotoxicity ratings and root infestation measurements were taken on August 22, 27 and 21 for Sites 1 to 3, respectively. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semicircle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 20 cm radius of the main shoots were assessed.

The length of infested root was measured and later converted to an infestation class (0-4) as shown in Table 1. Factorial analysis was conducted for each insecticide with site, rate and method of application being factors. A square root (x + 0.5) transformation was conducted on root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: No phytotoxic damage was noted for saskatoons treated with ORTHENE or ADMIRE. Leaf curl symptoms were noted at Site 1 and 3 on most plants (check and treated). Herbicide drift or mites were probably the cause of these symptoms.

WEA infested 54.3% of the check plants for a mean infestation rating of 1.67 (Table 2 and 3). Site 3 had a significantly higher mean infestation rate than Sites 1 and 2. The method of water application on the check plants had no significant affect on WEA infestation rates.

WEA infested 10.0% of the ORTHENE treated plants for a mean infestation rate of 0.17 (tables 4, 5, 6 and 7). The infestation rate for all plants treated with the low, medium and high rate of ORTHENE was 0.27, 0.15 and 0.09, respectively (table 6). The high rate of ORTHENE significantly reduced the infestation rating compared to the mid and low rates of ORTHENE. The mean infestation rating for all ORTHENE treated plants with the 1 L injection, 2 L injection, 2 L drench and 10 L drip was 0.09, 0.34, 0.10 and 0.15, respectively (table 7). For ORTHENE treatments, the 2 L injection method was not as effective as the other methods of application. There was a significant interaction between site and method of application. The 2 L ORTHENE injection worked better at Site 2 than at Sites 1 or 3. Site 2 had a sandy loam soil whereas Sites 1 and 3 had a clay loam. It may be that for ORTHENE application, the injector worked better in light soils.

WEA infested 21.3% of the ADMIRE treated plants for a mean infestation rate of 0.44 (tables 8, 9, 10 and 11). The infestation rate for all plants treated with the low and high rate of ADMIRE was 0.44 and 0.43, respectively (table 10). The mean infestation rate for all ADMIRE treated plants with the 1 L injection, 2 L injection, 2 L drench and 10 L drip was 0.82, 0.20, 0.35 and 0.38, respectively (table 11). ADMIRE applied by 1 L injection was not as effective as the other methods of application. There was a significant interaction between site and method of application. The 2 L drench and the 10 L drip ADMIRE treatments did not work as well at Site 1 as at Site 2 and 3. The soil at Site 1 was more compacted. It may be that in compacted soils, ADMIRE will not move as well to the root zone with the drench and drip treatments as compared to soil injection.

CONCLUSIONS: ORTHENE and ADMIRE did not cause phytotoxic damage to saskatoon seedlings when applied to the roots. ORTHENE and ADMIRE were both effective in reducing the incidence and infestation ratings of woolly elm aphid on non-fruit bearing saskatoon seedlings. ORTHENE at rates between 0.65 and 1.70 g product per plant was more effective than ADMIRE at rates between 0.063 and 0.125 mL per plant. For the rates tested, ORTHENE showed a rate response whereas ADMIRE did not. Soil drench and drip treatments were effective alternative application methods to the currently registered soil injection treatment. Reducing the soil injection application volume to 1 L per plant was effective for ORTHENE but not for ADMIRE. For both ADMIRE and ORTHENE, the performance of the four application methods varied at the three test sites. Soil type and condition were potential reasons for this variation in performance.

Table 1. Woolly elm aphid infestation ratings used for evaluation of products on saskatoon plants in 1996.

Infestation rating	cm of aphid infested roots
0	0
1	1-3
2	4-7
3	8-14
4	15+

Table 2. Percentage of saskatoon plants infested with woolly elm aphid in CHECK plots following water application by three methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Percent infested with WEA			
				Site 1	Site 2	Site 3	Mean
WATER CHECK	-	Inject	2	50	30	78	52.7
WATER CHECK	-	Drench	2	40	30	90	53.0
WATER CHECK	-	Drip	10	60	30	80	56.7
Mean				50.0	30.0	82.7	54.2

Table 3. Infestation ratings for woolly elm aphid on saskatoon seedlings for CHECK plants treated with water applied by three methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Aphid infestation rating* Site 1	Site 2	Site 3	Mean
WATER CHECK	-	Inject	2	1.44	1.20	2.44	1.68 A
WATER CHECK	-	Drench	2	1.60	1.10	2.60	1.77 A
WATER CHECK	-	Drip	10	1.20	1.10	2.40	1.57 A
Mean				1.41 b	1.13 b	2.48 a	1.67

* Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

Table 4. Percentage of saskatoon plants infested with woolly elm aphid in plots treated with ORTHENE at three rates and four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Percent infested with WEA Site 1	Site 2	Site 3	Mean
ORTHENE 75WP	0.65 g	Inject	1	20	10	0	10.0
ORTHENE 75WP	0.65 g	Inject	2	40	0	30	23.3
ORTHENE 75WP	0.65 g	Drench	2	30	10	20	20.0
ORTHENE 75WP	0.65 g	Drip	10	20	0	10	10.0
Mean				27.5	5.0	15.0	15.8
ORTHENE 75WP	1.10 g	Inject	1	10	0	10	6.7
ORTHENE 75WP	1.10 g	Inject	2	20	0	30	16.7
ORTHENE 75WP	1.10 g	Drench	2	0	0	10	3.3
ORTHENE 75WP	1.10 g	Drip	10	10	0	10	6.7
Mean				10.0	0.0	15.0	8.3
ORTHENE 75WP	1.70 g	Inject	1	10	0	0	3.3
ORTHENE 75WP	1.70 g	Inject	2	10	0	40	16.7
ORTHENE 75WP	1.70 g	Drench	2	0	0	10	3.3
ORTHENE 75WP	1.70 g	Drip	10	0	0	0	0.0
Mean				5.0	0.0	12.5	5.8
Mean				14.2	1.7	14.2	10.0

Table 5. Percentage of saskatoon plants infested with woolly elm aphid in plots treated with ORTHENE, all rates combined, for four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Percent infested with WEA			
				Site 1	Site 2	Site 3	Mean
ORTHENE 75WP	All	Inject	1	13.3	3.3	3.3	6.6
ORTHENE 75WP	All	Inject	2	23.3	0.0	33.3	18.9
ORTHENE 75WP	All	Drench	2	10.0	3.3	13.3	8.9
ORTHENE 75WP	All	Drip	10	10.0	0.0	6.7	5.6
Mean				14.2	1.7	14.2	10.0

Table 6. Infestation ratings for woolly elm aphid on saskatoon seedlings treated with ORTHENE at three rates and four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Aphid infestation rating*			
				Site 1	Site 2	Site 3	Mean
ORTHENE 75WP	0.65 g	Inject	1	0.3	0.1	0.0	0.13
ORTHENE 75WP	0.65 g	Inject	2	0.8	0.0	0.7	0.50
ORTHENE 75WP	0.65 g	Drench	2	0.3	0.2	0.2	0.23
ORTHENE 75WP	0.65 g	Drip	10	0.4	0.0	0.2	0.20
Mean				0.45	0.08	0.28	0.27 A
ORTHENE 75WP	1.10 g	Inject	1	0.2	0.0	0.1	0.10
ORTHENE 75WP	1.10 g	Inject	2	0.3	0.0	0.4	0.23
ORTHENE 75WP	1.10 g	Drench	2	0.0	0.0	0.1	0.03
ORTHENE 75WP	1.10 g	Drip	10	0.4	0.0	0.3	0.23
Mean				0.23	0.00	0.23	0.15 AB
ORTHENE 75WP	1.70 g	Inject	1	0.1	0.0	0.0	0.03
ORTHENE 75WP	1.70 g	Inject	2	0.1	0.0	0.8	0.30
ORTHENE 75WP	1.70 g	Drench	2	0.0	0.0	0.1	0.03
ORTHENE 75WP	1.70 g	Drip	10	0.0	0.0	0.0	0.00
Mean				0.05	0.00	0.23	0.09 B
Mean				0.24 a	0.03 b	0.24 a	0.17

* Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

Table 7. Infestation ratings for woolly elm aphid on saskatoon plants treated with ORTHENE, all rates combined, for four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Aphid infestation rating* Site 1	Site 2	Site 3	Mean
ORTHENE 75WP	All	Inject	1	0.20	0.03	0.03	0.09 B
ORTHENE 75WP	All	Inject	2	0.40	0.00	0.63	0.34 A
ORTHENE 75WP	All	Drench	2	0.10	0.07	0.13	0.10 B
ORTHENE 75WP	All	Drip	10	0.27	0.00	0.17	0.15 B
Mean				0.24 a	0.03 b	0.24 a	0.17

* Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test

Table 8. Percentage of saskatoon plants infested with woolly elm aphid in plots treated with ADMIRE at two rates and four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Percent infested with WEA Site 1	Site 2	Site 3	Mean
ADMIRE 24FL	0.063 mL	Inject	1	20	0	50	23.3
ADMIRE 24FL	0.063 mL	Inject	2	10	10	10	10.0
ADMIRE 24FL	0.063 mL	Drench	2	50	10	0	20.0
ADMIRE 24FL	0.063 mL	Drip	10	40	10	30	26.7
Mean				30.0	7.5	22.5	20.0
ADMIRE 24FL	0.125 mL	Inject	1	20	40	70	43.3
ADMIRE 24FL	0.125 mL	Inject	2	20	0	30	16.7
ADMIRE 24FL	0.125 mL	Drench	2	40	10	10	20.0
ADMIRE 24FL	0.125 mL	Drip	10	30	0	0	10.0
Mean				27.5	12.5	27.5	22.5
Mean				28.8	10.0	25.0	21.3

Table 9. Percentage of saskatoon plants infested with woolly elm aphid in plots treated with ADMIRE, all rates combined, for four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Percent infested with WEA			
				Site 1	Site 2	Site 3	Mean
ADMIRE 24FL	All	Inject	1	20	20	60	33.3
ADMIRE 24FL	All	Inject	2	15	5	20	13.3
ADMIRE 24FL	All	Drench	2	45	10	5	20.0
ADMIRE 24FL	All	Drip	10	35	5	15	18.3
Mean				28.8	10.0	25.0	21.3

Table 10. Infestation ratings for woolly elm aphid on saskatoon seedlings treated with ADMIRE at two rates and four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Aphid infestation rating*			
				Site 1	Site 2	Site 3	Mean
ADMIRE 24FL	0.063 mL	Inject	1	0.8	0.0	1.3	0.70
ADMIRE 24FL	0.063 mL	Inject	2	0.2	0.1	0.1	0.13
ADMIRE 24FL	0.063 mL	Drench	2	1.0	0.1	0.0	0.37
ADMIRE 24FL	0.063 mL	Drip	10	0.8	0.3	0.6	0.57
Mean				0.70	0.13	0.50	0.44 A
ADMIRE 24FL	0.125 mL	Inject	1	0.4	1.0	1.4	0.93
ADMIRE 24FL	0.125 mL	Inject	2	0.2	0.0	0.6	0.27
ADMIRE 24FL	0.125 mL	Drench	2	0.8	0.1	0.1	0.33
ADMIRE 24FL	0.125 mL	Drip	10	0.6	0.0	0.0	0.20
Mean				0.50	0.28	0.53	0.43 A
Mean				0.60 a	0.20 b	0.52 a	0.44

* Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

Table 11. Infestation ratings for woolly elm aphid on saskatoon plants treated with ADMIRE, all rates combined, for four application methods at three locations in Saskatchewan in 1996.

Treatment	Rate (product /plant)	Application method	Volume (L)	Aphid infestation rating* Site 1	Site 2	Site 3	Mean
ADMIRE 24FL	All	Inject	1	0.60	0.50	1.35	0.82 A
ADMIRE 24FL	All	Inject	2	0.20	0.05	0.35	0.20 B
ADMIRE 24FL	All	Drench	2	0.90	0.10	0.05	0.35 B
ADMIRE 24FL	All	Drip	10	0.70	0.15	0.30	0.38 B
Mean				0.60 a	0.20 b	0.52 a	0.44

* Means in the same column or row followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

END OF SECTION A

SECTION B - INSECT PESTS OF VEGETABLES AND SPECIAL CROPS /LÉGUMES ET CULTURES SPÉCIALES

- Reports/Rapports # 12-56
- Pages # 29-113

Section Editors: **Manitoba Westward/Du Manitoba vers l'ouest**
Dr. Jeff H. Tolman
Ontario Eastward/De l'Ontario vers l'est
Dr. Jeff G. Stewart

PMR REPORT # 012 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Brussels Sprouts, cv. Diablo
PEST: Imported cabbageworm, *Artogeia rapae* (L), cabbage looper, *Trichoplusia ni (Hbn.),* diamondback moth, *Plutella xylostella (L.)*

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: DIAMONDBACK MOTH CONTROL IN BRUSSELS SPROUTS

MATERIALS: DIPEL 2XDF (*Bacillus thuringiensis* var. *kurstaki*), XENTARI (*Bacillus thuringiensis* var. *aizawai* plus Lepidopteran active toxins), MONITOR 480LC (methamidophos), CYMBUSH 250EC (cypermethrin).

METHODS: Plots were established in a commercial grower's field near Paincourt, north of Chatham, Ontario. The grower applied two early sprays of CYMBUSH 250EC after planting but prior to plot establishment on July 5. DIPEL 2XDF at 1.1 kg product/ha was applied over the entire plot area as a cover spray on July 5 and 16. The grower used MONITOR 480LC at 2.0 L product/ha throughout the remainder of the season on a 10-12 day spray interval in his commercial field along side the research plot. Research plots were established on July 23. Treatments were initiated on July 23 and repeated on July 29, Aug. 2, 8, 14, 24, and Sept 5. Plots were two rows, 7 m in length replicated four times in a randomized complete block design. Foliar applications were made using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture. Assessments were taken by rating insect feeding damage per plot on Aug. 10, 29, and Sept. 16. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: Both the DIPEL 2XDF and XENTARI provided equal and similar control of leaf-feeding insects in Brussels sprouts. The growers' standard was ineffective. Early-season insect pressures were low, however, it appears that the last two applications in August or the Sept. application were most critical in insect control as significant foliar damage was observed two-three weeks later on September 16.

Table 1. Control of foliar insects causing damage to Brussels sprouts.

Treatments	Rate kg product/ha	Foliar Damage Ratings (0-10)* Aug. 10	 Aug. 29	 Sept. 16
DIPEL 2XDF	1.1	9.1a**	8.9a	7.6a
XENTARI	1.1	9.0a	8.5a	7.8a
Control		8.7a	8.2a	4.8b
GROWER STANDARD		8.9a	8.5a	3.3c

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 013 SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 303-1452-8703

CROP: Cabbage, cv. Minicole

PESTS: Imported cabbageworm (ICW), *Artogeia rapae (L.);* diamondback moth (DBM), *Plutella xylostella (L.)*

NAME AND AGENCY:
MACDONALD I K, SMITH M E and STEWART J G
Agriculture and Agri-Food Canada, Research Centre, P.O. Box 1210,
Charlottetown, Prince Edward Island C1A 7M8
Tel: (902) 566-6844 **FAX**: (902) 566-6821 **EMAIL**: STEWARTJ@EM.AGR.CA

TITLE: **MANAGEMENT OF LEAF-FEEDING PESTS OF CABBAGE, 1996**

MATERIALS: TD 2344-02 0.83 EC, CONFIRM 240 F, AMBUSH 500 EC, Food Grade Soybean Oil, Companion.

METHODS: Cabbage seedlings were transplanted 0.4 m apart in rows 0.9 m apart on June 12. Plots, measuring 3.6 m wide and 23.0 long, were arranged in a randomized complete block design with four replications. The number of leaf-feeding larvae were counted, using destructive samples, on six plants each week from head formation (July 31) until harvest (August 30). Insecticides were applied at head formation and again whenever a threshold of 0.25 Cabbage Looper Equivalents (CLE) per plant was reached or exceeded. The numbers of ICW and DBM larvae were multiplied by 0.67 and 0.2, respectively, to convert them to the appropriate CLE value. Insecticides were applied with a tractor-mounted CO_2-pressurized sprayer that delivered 320 L of spray volume per hectare at 240 kPa. The sticker COMPANION was used with Treatment 2 at a rate of 10 mL sticker per 10 L of water. After the initial treatment, insecticides were applied on the following dates: Treatment 2 on August 6, 16, 26 and Sept. 5 and all treatments on Aug. 6 and 26. Weeds were managed with a pre-plant application of trifluralin at 600 g AI/ha and with several mechanical cultivations. Marketability and head weights were recorded for ten heads harvested on August 30 from the center two rows of each plot. Heads were considered marketable if they were free of insects, feeding damage, and frass. Samples were taken from Treatment 2 for residue analysis. Analyses of variance (ANOVA) were performed on the data and the Least Squares Difference (LSD) was calculated if the ANOVA was significant at $P \leq 0.05$. The proportion of marketable heads (PM) was transformed to the sqrt(arcsine(PM)) before analysis. Detransformed means are presented.

RESULTS: The populations of insects were sparse in 1996. By Aug. 15, all treatments reduced the numbers of ICW significantly compared to the Check (Table 1). Significant differences in the numbers of DBM were not seen between treatments and the Check until August 22 (Table 2) when only TD 2344-02 and the full rate of AMBUSH were efficacious. Significantly more marketable heads were harvested from plots treated with insecticides than from the Check. The population of the leaf-feeding insects was too low to draw any conclusions regarding relative effectiveness of the use of AMBUSH at the full rate and the use of a reduced rate of AMBUSH plus Soybean Oil.

CONCLUSIONS: While differences were not statistically significant, the highest yield of cabbage was observed in plots treated with TD 2344-02.

Table 1. Impact of different insecticides on imported cabbageworm larvae (ICW), Harrington, P.E.I., 1996.

			--- Mean No. ICW Larvae/6 Plants ----				
Trmt		Rate	July	---------- August ----------			
No.	Product	(g AI/ha)	25	8	15	22	27
1	Check		0.0	0.1	1.0a*	3.0a	1.2a
2	CONFIRM	144	0.0	0.0	0.0b	0.0b	0.0b
3	TD 2344-02	39.7	0.0	0.1	0.0b	0.0b	0.0b
4	AMBUSH	35	0.0	0.0	0.0b	0.0b	0.0b
5	AMBUSH	17.5	0.8	0.0	0.0b	0.1b	0.0b
6	AMBUSH + SOYBEAN OIL	17.5+47	0.0	0.0	0.0b	0.1b	0.0b
ANOVA $P \leq 0.05$			ns	ns	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. Impact of different insecticides on diamondback moth (DBM)larvae, and yield of cabbage, Harrington, P.E.I, 1996.

Trmt No.	Product	Rate (g AI/ha)	Mean No. DBM Larvae/6 Plants August 15	22	27	Yield Total (t/ha)	Marketable (%)
1	Check		0.5	0.4a*	1.1	3.4	0b
2	CONFIRM	144	0.6	0.3ab	0.3	3.6	65a
3	TD 2344-02	39.7	0.0	0.0b	0.0	3.8	80a
4	AMBUSH	35	0.0	0.0b	0.0	3.7	60a
5	AMBUSH	17.5	0.1	0.1ab	0.1	3.5	60a
6	AMBUSH + SOYBEAN OIL	17.5+47	0.1	0.3ab	0.0	3.5	70a
ANOVA $P \leq 0.05$			ns	---	ns	ns	

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test ($P \leq 0.05$).

PMR REPORT # 014 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Cabbage, cv. Ramada, Broccoli cv. Paragon, Brussels Sprouts, cv.Valiant
PEST: Imported cabbageworm, *Artogeia rapae* (L), cabbage looper, *Trichoplusia ni* (Hbn.)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: **FOLIAR INSECT CONTROL WITH DIPEL FORMULATIONS IN COLE CROPS**

MATERIALS: DIPEL WP, and 2XDF (*Bacillus thuringiensis* var. *kurstaki*, XENTARI (*Bacillus thuringiensis* var. *aizawai* plus Lepidopteran active toxins).

METHODS: Cabbage, Broccoli, and Brussel sprouts were planted in single-row plots, 6 m in length with rows spaced 0.9 m apart, replicated four times in a randomized complete block design. Each cole crop was planted in a block of 5 rows each. Plants were transplanted using a commercial transplanter on June 11, 1996. Foliar applications were made using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture on July 17, 25, 31, Aug. 8, and 14. Assessments were taken by counting and/or rating insect feeding damage per plot on July 31, Aug. 17, 25, and Sept. 1. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: The lower rate of DIPEL 2XDF provided equal or often better control of imported cabbageworm compared to DIPEL WP at 1.1 kg product/ha (table 1). Control of these cole crop insects were significantly improved using the 2XDF formulation compared with the WP formulation. XENTARI provided equivalent control of cabbageworms compared to the DIPEL 2XDF and statistically improved control compared to DIPEL WP. These relationships proved consistant regardless of which cole crop was examined. Broccoli had initially fewer insect feeding sites throughout the trial followed by Brussels sprouts with cabbage showing the most cabbageworm damage.

Table 1. Control of foliar insects causing damage to Cabbage, Broccoli and Brussels Sprouts.

			Foliar Damage Ratings (0-10)*			
Treatments	Crop	Rate kg prod/ha	July 31	Aug. 17	Aug. 25	Sept. 1
DIPEL WP	Cabbage	1.1	6.9d**	6.8cd	7.0d	6.3de
DIPEL 2XDF	Cabbage	0.55	8.8abc	8.0ab	8.5ab	8.0ab
DIPEL 2XDF	Cabbage	1.1	9.0ab	7.9ab	8.8a	8.3ab
XENTARI	Cabbage	1.1	8.5abc	7.9ab	8.6ab	7.5bc
Control	Cabbage		4.0e	3.8e	4.3e	4.0g
DIPEL WP	Broccoli	1.1	9.0ab	8.3ab	8.0bc	6.0e
DIPEL 2XDF	Broccoli	0.55	8.5abc	8.3ab	7.8c	8.0ab
DIPEL 2XDF	Broccoli	1.1	9.0ab	9.0a	8.0bc	8.0ab
XENTARI	Broccoli	1.1	9.3ab	8.5ab	8.0bc	8.4a
Control	Broccoli		7.8cd	6.0d	6.8d	4.8f
DIPEL WP	Brussels Sprouts	1.1	8.3bc	8.3ab	7.0d	6.3de
DIPEL 2XDF	Brussels Sprouts	0.55	8.8abc	8.4ab	8.4abc	7.0cd
DIPEL 2XDF	Brussels Sprouts	1.1	9.5a	8.8ab	8.8a	7.6abc
XENTARI	Brussels Sprouts	1.1	9.0ab	8.4ab	8.3abc	6.3de
Control	Brussels Sprouts		4.8e	4.3e	4.3e	3.3h

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 015 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Cabbage, cv. Ramada, Broccoli cv. Paragon, Brussels Sprouts, cv.Valiant
PEST: Imported cabbageworm, *Artogeia rapae* (L), cabbage looper, *Trichoplusia ni* (Hbn.)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: **FOLIAR INSECT CONTROL WITH DIPEL FORMULATIONS IN COLE CROPS**

MATERIALS: DIPEL WP, and 2XDF (*Bacillus thuringiensis* var. *kurstaki*, XENTARI (*Bacillus thuringiensis* var. *aizawai* plus Lepidopteran active toxins).

METHODS: Cabbage, Broccoli, and Brussel sprouts were planted in single-row plots, 6 m in length with rows spaced 0.9 m apart, replicated four times in a randomized complete block design. Each cole crop was planted in a block of 5 rows each. Plants were transplanted using a commercial transplanter on June 11, 1996. Foliar applications were made using a specialized small-plot research $C0_2$ sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture on July 17, 25, 31, Aug. 8, and 14. Assessments were taken by counting and/or rating insect feeding damage per plot on July 31, Aug. 17, 25, and Sept. 1. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: The lower rate of DIPEL 2XDF provided equal or often better control of imported cabbageworm compared to DIPEL WP at 1.1 kg product/ha (table 1). Control of these cole crop insects were significantly improved using the 2XDF formulation compared with the WP formulation. XENTARI provided equivalent control of cabbageworms compared to the DIPEL 2XDF and statistically improved control compared to DIPEL WP. These relationships proved consistant regardless of which cole crop was examined. Broccoli had initially fewer insect feeding sites throughout the trial followed by Brussels sprouts with cabbage showing the most cabbageworm damage.

Table 1. Control of foliar insects causing damage to Cabbage, Broccoli and Brussels Sprouts.

			Foliar Damage Ratings (0-10)*			
Treatments	Crop	Rate kg prod/ha	July 31	Aug. 17	Aug. 25	Sept. 1
DIPEL WP	Cabbage	1.1	6.9d**	6.8cd	7.0d	6.3de
DIPEL 2XDF	Cabbage	0.55	8.8abc	8.0ab	8.5ab	8.0ab
DIPEL 2XDF	Cabbage	1.1	9.0ab	7.9ab	8.8a	8.3ab
XENTARI	Cabbage	1.1	8.5abc	7.9ab	8.6ab	7.5bc
Control	Cabbage		4.0e	3.8e	4.3e	4.0g
DIPEL WP	Broccoli	1.1	9.0ab	8.3ab	8.0bc	6.0e
DIPEL 2XDF	Broccoli	0.55	8.5abc	8.3ab	7.8c	8.0ab
DIPEL 2XDF	Broccoli	1.1	9.0ab	9.0a	8.0bc	8.0ab
XENTARI	Broccoli	1.1	9.3ab	8.5ab	8.0bc	8.4a
Control	Broccoli		7.8cd	6.0d	6.8d	4.8f
DIPEL WP	Brussels Sprouts	1.1	8.3bc	8.3ab	7.0d	6.3de
DIPEL 2XDF	Brussels Sprouts	0.55	8.8abc	8.4ab	8.4abc	7.0cd
DIPEL 2XDF	Brussels Sprouts	1.1	9.5a	8.8ab	8.8a	7.6abc
XENTARI	Brussels Sprouts	1.1	9.0ab	8.4ab	8.3abc	6.3de
Control	Brussels Sprouts		4.8e	4.3e	4.3e	3.3h

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 016 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Cabbage, cv. Ramada
PEST: Imported cabbageworm, *Artogeia rapae* (L), cabbage looper, *Trichoplusia ni* (Hbn.)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: **INSECT CONTROL IN CABBAGE**

MATERIALS: ADMIRE 240FS (imidacloprid), AGRAL 90 (surfactant), MATADOR 120EC (lambda-cyhalothrin), TD 2344-02 0.83EC (experimental), DECIS 2.5EC (deltamethrin).

METHODS: Cabbage were transplanted in single-row plots, 6 m in length with rows spaced 0.9 m apart, replicated four times in a randomized complete block design. Plants were transplanted using a commercial transplanter on June 10, 1996. The in-furrow applications were made in the transplant water at the time of transplanting. Foliar applications were made using a specialized small-plot research CO_2 sprayer with a two-nozzele hand-held boom applying 200 L/ha of spray mixture on July 4, 17, 25, 31, Aug. 8, and 14. Assessments were taken by counting and/or rating insect feeding damage per plot on July 3, 31, Aug. 17, 25, and Sept. 1. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: ADMIRE 240FS applied either in-furrow with the transplant water or as a foliar spray was ineffective in controlling the Lepidoptera species attacking cabbage compared to MATADOR 120EC and TD 2344-02 0.83EC. Both MATADOR 120EC and TD 2344-02 0.83EC provided excellent cabbage insect control with or without the use of the surfactant AGRAL 90. DECIS 2.5EC controlled the level of insect pressure but not as well as did MATADOR 120EC or TD 2344-02 during the later part of the growing season.

Table 1. Control of foliar insects causing damage to cabbage.

Treatments	Rate product/	Application	# of Feeding sites per plot	Foliar Damage Ratings (0-10)*			
			July 3	July 31	Aug. 17	Aug. 25	Sept. 1
ADMIRE 240FS	7.0 ml/100m	In-Furrow	3.0cd**	7.0c	4.9bc	5.0e	4.5d
ADMIRE 240FS	10.0 ml/100m	In-Furrow	3.5bcd	9.3a	5.1b	7.0d	5.3d
ADMIRE 240FS +	200.0 ml/ha	Foliar					
AGRAL 90	0.03% v/v		8.5a	8.4b	5.3b	7.3d	6.5c
MATADOR 120EC +	83.3 ml/ha	Foliar					
AGRAL 90	0.03% v/v		2.3d	10.0a	9.5a	9.4ab	8.5a
MATADOR 120CSO +	83.3 ml/ha	Foliar					
AGRAL 90	0.03% v/v		6.0a-d	9.8a	8.8a	9.4ab	8.6a
MATADOR 120CSO	8.83 ml/ha	Foliar	5.3a-d	10.0a	9.1a	9.2b	8.1ab
TD 2344-02 0.83EC	473.5 ml/ha	Foliar	5.8a-d	10.0a	9.0a	10.0a	8.6a
TD 2344-02 0.83EC +	473.6 ml/ha	Foliar					
AGRAL 90	0.03% v/v		7.5ab	9.8a	8.6a	10.0a	8.9a
DECIS 2.5EC	300.0 ml/ha	Foliar	3.8bcd	9.3a	9.0a	8.0c	7.3bc
Control			7.3abc	6.3d	4.0c	5.0e	4.9d

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** Means followed by the same letter do not significantly differ (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 017 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 86100104

CROP: Cabbage, cv. Survivor
PEST: Imported cabbageworm, *Artogeia rapae* (L.)

NAME AND AGENCY:
SEARS M K and MCGRAW R R
Department of Environmental Biology, University of Guelph, Guelph, Ontario,
N1G 2W1 **Tel:** (519) 824-4120, ext. 3567 **Fax:** (519) 837-0442
Email: msears@evbhort.uoguelph.ca

TITLE: **THE CONTROL OF IMPORTED CABBAGEWORM ON CABBAGE 1996**

MATERIALS: GFU383C and WF1621 (fenpropathrin 120 EC), AGRAL, SPINOSAD NAF 85 (*Saccharopolyspora spinosa* 480 EC), LORSBAN (chlorpyrifos 480 EC), DECIS (deltamethrin 5 EC).

METHODS: Cabbage seedlings were transplanted July 4, in four-row plots, 15 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. A pre-treatment count on August 22 indicated a build up in the population of imported cabbageworms (ICW). Insecticides were applied on August 26 with a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. Treatments were evaluated on August 29 by removing five plants from the centre two rows and examining them for larvae.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: Imported cabbageworm larvae were controlled by Decis, the two higher rates of Spinosad, and the GFU383C formulation of fenpropathrin. The other treatments reduced the number of larvae but these numbers were not statistically different than the untreated plots.

Table 1. Comparison of the efficacy of several insecticides against ICW larvae, Guelph, Ontario, 1996.

Treatment	g AI/ha	ICW/5 plants*
MATADOR 120EC (GFU383C)+ AGRAL 90	10 + 0.03 %v/v	0.25 c
MATADOR 120EC (WF1621) + AGRAL 90	10 + 0.03 %v/v	4.5 abc
SPINOSAD NAF 85	5.0	6.5 ab
SPINOSAD NAF 85 + LORSBAN	5.0 + 120.0	4.0 abc
SPINOSAD NAF 85	25.0	3.5 bc
SPINOSAD NAF 85	50.0	2.5 bc
DECIS 5 EC (standard)	10.0	2.0 bc
UNSPRAYED CHECK	-	9.3 a

* Means followed by the same letter are not significantly different at P•0.05 (Tukey's Studentized Range Test).

PMR REPORT # 018 SECTION B: VEGETABLE AND SPECIAL CROPS

CROP: Filbert, cv. Barcelona
PEST: Filbert Aphid, *Myzocallis coryli Goetze*

NAME AND AGENCY:
FREEMAN J A and MCMURRAN D L
Freeman Agri Research Service, Box 78, Agassiz, B.C. V0M 1A0
Tel: (604) 796-2534 **Fax**: (604) 796- 2538

TITLE: EFFICACY OF DIAZINON FOR CONTROL OF APHIDS ON FILBERTS - 1996

MATERIALS: DIAZINON 500 EC (diazinon)

METHODS: Trials were replicated 4 times in a randomized complete block design. In tests 1 and 2, each plot consisted of 2 trees. Diazinon (TRT 1) was applied on July 8, Aug 14 and Sept 27 at 500 g ai/ha. Tapwater (TRT 2) was applied at

1000 L/ha on July 8 to determine if it had any effect on aphid populations. The sprays were applied with a C02 backpack sprayer at 1000 L water/ha, pressure of 100 psi. 12 leaf samples from each treatment were collected July 8 (pre-spray), July 11 (24 hrs. post-spray), July 12 (48 hrs. post-spray) and July 19 (7 days post-spray). In test 3, each plot consisted of 3 trees. Diazinon was applied on July 23, Aug 15 and Sept 27 (Test 3 was set up the same as Tests 1 and 2). Leaf samples were collected on July 22 (pre-spray), July 24 (24 hrs. post-spray), July 25 (48 hrs. post-spray) and July 29 (7 days post-spray). Tapwater was applied on July 23. Leaves were placed in containers, sealed and frozen. Aphid counts were recorded between September 1 - 15. Leaf samples were taken with the first application of sprays only due to a lack of aphids. Three applications of diazinon were applied for residue studies.

RESULTS: See Tables 1, 2 and 3.

CONCLUSIONS: Diazinon significantly reduced the number of aphids. Water did not affect the number of aphids significantly. Yields were not affected detrimentally by any of the treatments.

Table 1. Test 1 - Number of aphids per 12 filbert leaves pre- and post-spraying with diazinon or water.

Treatment	Rate	Number of Aphids/Plot			
	ai/ha	Pre-spray	Post-spray		
		July 8	July 11	July 12	July 19
DIAZINON	500 g	421.25a*	4.50b	3.25b	17.00b
Water	1000 L	352.50a	220.00a	131.00a	125.00a
Check	--	255.50a	319.25a	154.50a	93.50a
ANOVA P<0.05					

Table 2. Test 2 - Number of aphids per 12 filbert leaves pre- and post-spraying with diazinon or water.

Treatment	Rate	Number of Aphids/Plot			
	ai/ha	Pre-spray	Post-spray		
		July 8	July 11	July 12	July 19
DIAZINON	500 g	468.25a	0.50c	2.25b	17.00b
Water	1000 L	260.00b	196.50b	254.75a	125.00a
Check	--	333.25ab	391.00a	346.75a	93.50a
ANOVA P<0.05					

Table 3. Test 3 - Number of aphids per 12 filbert leaves pre- and post-spraying with diazinon or water.

Treatment	Rate ai/ha	Number of Aphids/Plot Pre-spray July 22	Post-spray July 24	Post-spray July 25	Post-spray July 29
DIAZINON	500 g	197.25a	2.25b	0.50b	2.50b
Water	1000 L	180.75a	83.25a	72.75a	55.75a
Check	--	134.00a	92.50a	98.50a	79.00a
ANOVA P<0.05					

* Figures are the means of 4 replications. Numbers within columns, followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P<0.05).

REPORT # 019 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1241-9371

CROP: North American ginseng, *Panax quinquefolius* L.
PEST: Darksided cutworm (DSCW), *Euxoa messoria* (Harris)

NAME AND AGENCY:
TOLMAN J H and VanHooren K A
Agriculture and Agri-Food Canada, Pest Management Research Centre, 1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 ext. 232 **Fax**: (519) 457-3997 **E-mail**: tolmanj@em.agr.ca

TITLE: EVALUATION OF AMBUSH 500 EC FOR CONTROL OF DARKSIDED CUTWORM ATTACKING GINSENG IN MINERAL SOIL

MATERIALS: AMBUSH 500 EC (permethrin).

METHODS: Plots, 3.5 m long and separated from each other by 0.5 m buffer strips, were established down the length of 2 ginseng beds in a 0.5 ha garden planted in Fox sandy loam in October 1994 on the Delhi Farm of the Pest Management Research Centre and subsequently managed using commercially recommended practices. All treatments were replicated three times in a randomized complete block design. A single galvanized metal microplot, 1.0 m x 0.25 m x 0.2 m high was established in each plot along the crown of the bed by gently retracting the straw mulch (2-5 cm thick) along the base of the microplot and pushing the base of the microplot at least 2 cm down into the moist soil. The straw was then packed along the inside of the microplot and the number of ginseng seedlings (5-6 cm tall) in each microplot counted. On June 19 a total of 15 fifth instar DSCW, reared from the egg stage in the laboratory, were released into each microplot. After larvae had burrowed down into the mulch, insecticide was applied in 400 L/ha at 200 kPa using a hand-held CO_2-pressurized field sprayer fitted with 4 - XR8004VS flat fan spray tips. Microplots were then covered to prevent bird predation. On June 21 and 28 feeding damage to seedlings was rated using a 0-6 scale. Percentage of seedlings in each damage category was calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by ANOVA; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS: See Table 1. below.

CONCLUSIONS: By 2 days after application nearly 60% of ginseng seedlings in untreated plots exhibited DSCW-feeding damage. On the same date, foliage of over 90% of seedlings in plots treated with either rate of AMBUSH showed no feeding damage. While no seedlings in plots treated with AMBUSH exhibited severe DSCW-feeding damage by Day 2, feeding DSCW had severely damaged leaves of 20% of seedlings in untreated plots. Only slight additional feeding damage was recorded 7 days after the initial rating. Application of AMBUSH thus effectively controlled feeding on ginseng seedlings by introduced, late instars of the DSCW.

Table 1. Control of damage to ginseng seedlings by foliar applications of AMBUSH 500 EC.

No.	Treatment	Rate (g AI/ ha)	Mean % Ginseng Seedlings with Indicated Damage Score*					
			---- June 21 1996 ----			---- June 28 1996 ----		
			0	1-3	4-6	0	1-3	4-6
1	AMBUSH	70.0	95.8 a**	4.1 a	0.0 a	92.5 a	7.5 a	0.0 a
2	AMBUSH	100.0	93.5 a	6.5 a	0.0 a	90.3 a	9.7 a	0.0 a
3	CONTROL	---	42.3 b	30.3 b	20.0 b	36.3 b	39.1 b	24.6 b

* Damage Rating (0-6 scale where 0 represents no feeding damage; 1 - light damage on 1 leaflet of trifoliate; 2 - light damage on 2 leaflets; 3 - light damage on 3 leaflets; 4 - severe (>50% of leaflet consumed) damage on 1 leaflet; 5 - severe damage on 2 leaflets; 6 - severe damage on 3 leaflets).

** Means within a column followed by the same letter are not significantly different (P•0.05) as determined by Duncan's New Multiple Range Test.

PMR REPORT # 020 **SECTION B: VEGETABLE AND SPECIAL CROPS**
STUDY DATA BASE: 390 1252 9201

CROP: Lettuce, cv. Target
PEST: Lettuce aphid, *Nasonovia ribisnigri* (Mosley)

NAME AND AGENCY:
BROOKES V R
Agriculture & Agri-Food Canada, PARC, Agassiz, B.C. V0M 1A0
Tel: (604) 796-2221 **Fax**: (604) 796-0359 **Email**: BROOKES@EM.AGR.CA

TITLE: **EFFICACY OF FOLIAR APPLICATION OF ADMIRE AGAINST LETTUCE APHID, 1996**

MATERIALS: ADMIRE 240 g/l (imidacloprid)

METHODS: The trial was conducted at PARC-Agassiz. Plots consisted of three rows of lettuce spaced 30 apart on raised beds with 30 cm between plants, with four replications per plot. Each plot was 10 m long. Lettuce was transplanted on May 23. The treatments were applied in 600 L/ha water with a pressurized backpack sprayer. ADMIRE at 48 g ai/ha was applied either as a single and as a two-spray regime. The first spray was applied July 4 and the second on July 11. Lettuce aphid counts were taken July 23.

RESULTS: Two sprays of ADMIRE significantly reduced the numbers of lettuce aphids (Table 1).

CONCLUSIONS: Multiple sprays of ADMIRE can effectively control lettuce aphid.

Table 1. Mean Lettuce aphid counts from two lettuce heads in ADMIRE treated and untreated plots at Agassiz, B.C. in 1996.*

Treatments	Rate (g ai/ha)	Lettuce Aphid Counts
Check	---	4.0a
ADMIRE (2 sprays)	48	0.1b
ADMIRE (1 spray)	48	3.0a

* Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P<0.05).

PMR REPORT # 021 **SECTION B: VEGETABLE AND SPECIAL CROPS**
STUDY DATA BASE: 390 1252 9201

CROP: Lettuce, cv. Target
PEST: Lettuce aphid, *Nasonovia ribisnigri* (Mosley)

NAME AND AGENCY:
BROOKES V R
Agriculture & Agri-Food Canada, PARC, Agassiz, B.C. V0M 1A0
Tel: (604) 796-2221 **Fax**: (604) 796-0359 **Email**: BROOKES@EM.AGR.CA

TITLE: **EFFICACY OF DRENCH APPLICATION OF ADMIRE AGAINST LETTUCE APHID, 1996**

MATERIALS: ADMIRE 240 g/l (imidacloprid)

METHODS: The trial was conducted at PARC-Agassiz. Plots consisted of three rows of lettuce spaced 30 apart on raised beds with 30 cm between plants, with four replications per plot. Each plot was 10 m long. Lettuce was transplanted on May 21. The treatments were applied as drenches in 2000 l/ha water with a pressurized backpack sprayer. ADMIRE at 156 g ai/ha was applied May 28 and Admire at 312 g ai/ha was applied May 30. Lettuce aphids were placed on two random lettuce heads per plot on June 13. Aphid counts were taken on the infested lettuce heads on July 16.

RESULTS: ADMIRE significantly reduced the numbers of lettuce aphids (Table 1).

CONCLUSIONS: One post planting drench application of ADMIRE effectively controlled lettuce aphid.

Table 1. Mean Lettuce aphid counts from two lettuce heads in ADMIRE treated and untreated plots at Agassiz, B.C. in 1996.*

Treatments	Rate (g ai/ha)	Lettuce Aphid Counts
Check	---	7.8 a
ADMIRE	156	1.1 b
ADMIRE	312	0.9 b

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

PMR REPORT # 022 **SECTION B: INSECTS OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Yellow cooking onions
PEST: Onion Maggot Fly, *Delia antiqua* (Meigen)

NAME AND AGENCY:
MCDONALD M R, JANSE S, and VANDER KOOI K
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775 3783 **Fax**: (905) 775 4546

TITLE: EVALUATION OF TRANSPLANTED ONION LINES FOR MAGGOT FLY RESISTANCE.

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Dr. R. Maxwell, Petoseed, Payette, Idaho, and 2 commercial cultivars Fortress and Norstar.

METHODS: Twenty-six onion lines were seeded into 288 plug trays on April 10. The trial was conducted at the Muck Research Station where onion maggot flies are naturally present. The transplants were planted out on May 21, 22, 23 and 24 in organic soil. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 2 rows (43 cm apart), 4 m in length. Norstar and Fortress were used as commercial comparisons for the trial. Both cultivars were treated with the following: 1.6 mL of LORSBAN 4E per tray in 500 mL of water (full rate), 0.8 mL of LORSBAN 4E per tray in 500 mL of water (half rate) and an untreated check. No other insecticides were applied to any lines throughout the trial period. Damage assessment began approximately one week after the first generation peak (June 20) of onion maggot flies. Maggot damage was assessed once a week by rogueing out wilted onions and looking for symptoms of maggot damage at the base of the plant. Final damage assessments were done on August 27 and 28. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant ($P=0.05$) differences were found between resistant lines. All control treatments with LORSBAN 4E (full and/or half rates) had the lowest percent damage. Seven of the twenty resistant lines had less than 10% total maggot damage. One resistant line PSR 459494 had a harvest weight of 22.07 kg which was comparable to the controls which averaged 20 kg. Several resistant lines showed some potential with low maggot damage and good harvest yield.

Table 1. Percent onion maggot damage of transplanted yellow cooking onion lines at the Muck Research Station, Bradford, Ontario in 1996.

Treatment	1st generation (%)	Harvest assessment (%)	Total damage (%)	Weight (kg)
Norstar (full rate)	0.0 a*	1.3 a	1.3 a	19.94 abc
Norstar (half rate)	0.0 a	3.2 a-d	3.2 ab	19.87 abc
Fortress (half rate)	0.2 a	4.7 a-e	4.9 abc	23.60 a
Fortress (full rate)	0.4 ab	1.9 ab	2.3 ab	21.52 ab
Norstar (check)	0.9 ab	6.3 a-g	7.2 a-d	15.53 d-g
WR 459	2.3 abc	4.6 a-e	6.9 a-d	9.50 jk
XW 459 C	2.4 abc	4.9 a-f	7.3 a-d	14.71 d-i
W 458C	2.7 a-d	4.4 a-e	7.1 a-d	12.20 f-j
PSR 459494	2.9 a-d	5.8 a-g	8.7 a-d	22.07 ab
W 455 B	3.2 a-d	6.9 a-g	10.1 a-d	12.51 f-j
WR 458	3.8 a-d	5.7 a-g	9.5 a-d	6.76 k
PSR 458994	4.1 a-d	8.1 a-h	12.2 a-d	14.81 d-h
PSR 459094	4.3 a-d	2.8 a-d	7.1 a-d	12.48 f-j
XW 458 C	5.0 a-d	2.3 abc	5.3 abc	16.77 cde
W457 C	6.0 a-d	10.0 c-h	16.0 a-d	11.57 g-j
PSR 459294	6.3 a-d	12.1 e-h	18.3 a-e	15.76 def
W 454 B	6.8 a-d	3.5 a-d	10.3 a-d	10.45 jk
Fortress (check)	8.0 a-d	11.6 e-h	19.6 b-c	14.98 d-h
AW 455 B	8.2 a-d	10.2 d-h	18.4 a-e	18.48 bcd
PSR 459194	8.8 a-d	12.6 fgh	21.4 cde	10.70 ijk
PSR 459394	9.5 bcd	8.4 a-h	17.9 a-e	13.19 e-j
PSR 459594	1.1 cde	12.2 e-h	23.3 def	12.42 f-j
W 459 C	11.6 de	9.3 b-h	20.9 cde	9.10 jk
PSR 459694	11.8 de	7.3 a-h	19.1 b-e	11.90 f-g
W 456	19.8 ef	14.5 h	34.3 ef	12.84 e-j
W 456 C	26.4 f	12.9 g-h	39.3 f	13.19 e-j

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D. Test.

PMR REPORT # 023 **SECTION B: INSECTS OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 200603

CROP: Yellow cooking onions
PEST: Onion Maggot Fly, *Delia antiqua* (Meigen)

NAME AND AGENCY:
MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario LOG 1JO
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: EVALUATION OF SEEDED ONION LINES FOR MAGGOT FLY RESISTANCE

MATERIALS: Onion breeding lines obtained from Dr. I. Goldman, University of Wisconsin, Dr. Rob Maxwell, Petoseed, Payette, Idaho and Asgrow Canada, and two commercial cultivars, Norstar and Fortress.

METHODS: Thirty-one onion lines were direct seeded (36 seeds/m) on May 16 and 17. The trial was conducted at the Muck Research Station where onion maggot flies are naturally present. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 2 rows (43 cm apart), 2 meters in length. Norstar and Fortress were used as commercial comparisons for the trial. Both cultivars were treated with the following: 64 g LORSBAN 15G per 100 meter row (full rate), 32 g LORSBAN 15G per 100 meter row (half rate), and an untreated check. No other insecticides were applied to any lines throughout the trial period. Germination counts were conducted on June 5 and 10. Damage assessment began one week after first generation peak (June 20) of onion maggot flies. Maggot damage was assessed once a week by rogueing out wilting onions and looking for symptoms of maggot damage at the base of the plant. Final damage assessments were done on September 17 and 18. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant (P=0.05) differences in resistance to onion maggot were found among the lines. Fifteen lines had less than 10% total damage. Only one line PSR 459394 had less total damage than the Fortress full rate with LORSBAN 15G at 64 g/100 m row.

Table 1. Percent onion maggot damage of direct seeded yellow cooking onion lines at the Muck Research Station, Bradford, Ontario in 1996.

Treatment	1st generation	Harvest assessment	Total damage (%)
PSR 459394	0.2 a *	2.5 ab	2.7 a
Fortress (full rate)	0.5 ab	2.3 abc	2.8 a
WR 458	1.0 ab	7.0 abc	8.0 a-f
AW 455 B	1.3 ab	6.0 abc	7.3 a-e
Fortress (check)	1.5 abc	3.8 abc	5.3 abc
PSR 458994	1.9 a-d	2.9 abc	4.8 ab
W 454 B	2.0 a-d	7.1 abc	9.1 a-f
PSR 459094	2.3 a-d	4.2 abc	6.5 a-d
W 458 C	2.3 a-d	4.3 abc	6.6 a-d
W 459 C	2.6 a-d	3.9 abc	6.5 a-d
W 457 C	2.7 a-d	4.6 abc	7.3 a-e
XW 459 C	3.1 a-d	5.5 abc	8.6 a-f
PSR 459494	3.3 a-d	3.5 abc	6.8 a-d
PSR 459694	3.4 a-d	2.9 abc	7.3 a-d
PSR 459194	3.5 a-d	2.5 ab	6.0 a-d
WR 459	3.5 a-d	6.5 ab	10.0 a-g
PSR 459594	3.6 a-d	5.3 abc	8.9 a-f
Norstar (half rate)	3.8 a-c	6.0 abc	9.8 a-g
Fortress (half rate)	3.8 a-e	7.7 bc	11.6 a-g
W 456 C	4.0 a-e	8.3 c	12.1 a-g
PSR 459294	5.4 a-f	2.2 a	7.6 a-e
XPH 15055	6.3 a-f	4.9 abc	11.2 a-g
Norstar (check)	6.7 a-f	5.5 abc	12.2 a-g
XW 458 C	7.1 a-f	6.3 abc	11.9 a-g
Norstar (full rate)	8.5 b-f	6.9 abc	15.3 c-g
XPH 15059	9.4 c-f	6.4 abc	15.8 d-g
XPH 15057	9.7 def	4.1 abc	13.8 b-g
XPH 15058	11.2 f	6.0 abc	19.6 g
W 456	11.7 ef	6.2 abc	17.9 fg
XPH 15056	12.4 f	4.8 abc	17.2 e-g

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D. Test.

PMR REPORT # 024 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 84100737

CROP: Onions, cv. Prince
PEST: Onion maggot, *Delia antigua* (Meig.)

NAME AND AGENCY:
RITCEY G and HARRIS C R
Department of Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1
Tel: (519) 824-4120, ext. 3333 **Fax:** (519) 837-0442
E-mail: cgagnon@evbhort.uoguelph.ca

TITLE: **INSECTICIDE SEED COATINGS AND GRANULAR INSECTICIDE FOR ONION MAGGOT CONTROL**

MATERIALS: LORSBAN 15 G (chlorpyrifos), AZTEC 2.1 G (phosetbupirin 2% + cyfluthrin 0.1%), TRIGARD 75% (cyromazine), LORSBAN 48% (chlorpyrifos), EXP80415A 500 g/L (fipronil), PRO GRO (carbathiin 30% + thiram 50%).

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. The experimental plot was arranged in a randomized complete block design with four replications. Each two-row plot was 6 m long with a spacing of 40 cm between the rows. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. The granular formulations were applied in the furrow at planting time (May 15, 1996) by adding them with the seed on a V-belt planter. Estimates for the effectiveness of treatments were made by counting the number of plants in each row to determine the initial stand on June 6 and then by examining one row in each plot twice weekly from June 10 to July 18 to determine onion maggot damage. On each sample date plants that were wilted from onion maggot damage were counted and removed. On July 24, the remaining plants were pulled and examined for onion maggot damage. On August 29 the second row of plants were pulled and examined for damage.

RESULT: Data are presented in Table 1.

CONCLUSION: All the commercial seed treatments in combination with furrow treatments were effective in controlling the first generation of the onion maggot (Table 1). In comparing the single granular applications the higher rate of the AZTEC granular treatment was more effective than the LORSBAN granular treatment. The seed treatments with no addition of granular treatment were effective in controlling the onion maggot. By the end of August there was high plant loss (95%) in the check due to a combination of onion maggot infestation and extremely high onion smut damage.

Table 1. Initial stand, percent maggot damage, and percent stand loss following the indicated granular and seed treatments at seeding.

Granular treatments	Rate kg AI/ha	Seed treatments	Rate g AI/kg	Initial plant count / 6 m row	% maggot damage* / 6 m row	% stand loss**
LORSBAN 15 G	1.1	TRIGARD	25	227abcd***	8.2de	56.6bcd
LORSBAN 15 G	1.1	TRIGARD	50	236ab	1.9de	42.6de
LORSBAN 15 G	1.1	EXP80415A	25	230abc	2.5de	52.8bcd
LORSBAN 15 G	1.1	EXP80414A	50	219abcd	1.9de	43.8de
AZTEC 2.1 G	0.5	TRIGARD	25	225abcd	2.9de	49.7cde
AZTEC 2.1 G	0.5	TRIGARD	50	211abcd	0.7e	35.7e
AZTEC 2.1 G	0.5	EXP80415A	25	223abcd	1.1e	51.1bcde
AZTEC 2.1 G	0.5	EXP80415A	50	213abcd	1.9e	42.4de
AZTEC 2.1 G	0.25	TRIGARD	50	200cd	2.0de	44.2de
AZTEC 2.1 G	0.25	EXP80415A	50	242a	2.0de	52.0bcd
LORSBAN 15 G	1.1	----		229abc	42.0b	56.1bcd
AZTEC 2.1 G	0.25	----		225abcd	24.7c	62.1bc
AZTEC 2.1 G	0.5	----		215abcd	8.8d	50.9cde
----		TRIGARD	25	216abcd	7.2de	69.3b
----		TRIGARD	50	207bcd	3.5de	42.4de
----		EXP80415A	25	235ab	3.5de	55.9bcd
----		EXP80415A	50	227abcd	1.8e	47.8cde
Check	---	----		195d	61.2a	95.0a
ANOVA P•0.05				33	6.8	17.3

* Accumulative counts June 10, 14, 17, 21, 25, 28, July 2, 5, 8, 12, 16, 18, and 24.

** 1st and 2nd generation final count August 29.

*** Means followed by the same letter are not significantly different (P•0.05; LSD test).

PMR REPORT # 025 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 84100737

CROP: Onions, cv. Prince
PEST: Onion maggot, *Delia antiqua* (Meig.); onion smut, *Urocystis cepulae* Frost

NAME AND AGENCY:

RITCEY G and HARRIS C R
Department of Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1
Tel: (519) 824-4120, ext. 3333 **Fax**: (519) 837-0442
E-mail: cgagnon@evbhort.uoguelph.ca

TITLE: INSECTICIDE SEED COATINGS FOR ONION MAGGOT CONTROL

MATERIALS: TRIGARD 75% (cyromazine), LORSBAN 48% (chlorpyrifos), EXP80415A 500 g/L (fipronil), PRO GRO (carbathiin 30%, thiram 50%).

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. The trial was arranged in a randomized complete block design with four replications. Commercial film seed coatings (Bejo FILMKOTE) were provided by

Bejozaden Ltd., Warmenhuizen, Holland. Seed treated with PRO GRO was applied in the furrow at planting (May 14, 1996) using an Earthway precision garden seeder. Each two-row plot was 6 m long and spaced 40 cm apart. The number of plants in each row was counted for initial stand on June 6 and then examined twice weekly from June 10 to July 18 for onion maggot damage. On each sample date plants wilting from onion maggot were counted and removed. On July 23, the remaining plants were pulled and examined for onion maggot damage. On August 28 the second row of plants were pulled and examined for damage. On July 18, 50 plants with four replicates were removed to determine smut infection. The plants were rinsed with water to remove adhering dirt and then the bulb was examined visually for smut symptoms.

RESULTS: Data are presented in Table 1.

CONCLUSION: With the high level of maggot infestation (49.5%), the higher rates of the commercial seed treatments of TRIGARD and EXP80415A were more effective than the seed treatment LORSBAN in controlling the first generation of the onion maggot (Table 1). By the end of the second generation, there was high plant loss due mainly to extremely high onion smut damage (range 52% to 65%). In comparing stand count there was no signicant difference between the check and the insecticide treated seed.

Table 1. Initial stand and percent maggot damage, stand loss and onion smut following the indicated seed treatment.

Seed treatments	Rate (g AI/kg seed)	Initial plant count /6 m row	% maggot damage/6 m* Gen. 1	% stand loss Gen. 2	% onion smut
TRIGARD	25.0	214bc**	8.6c	79.0bc	57
TRIGARD	50.0	212bc	1.5c	67.7c	56
TRIGARD	75.0	206bc	2.7c	68.3c	59
LORSBAN	25.0	193c	29.9b	88.3ab	61
LORSBAN	50.0	202bc	26.5b	86.4ab	65
LORSBAN	75.0	199bc	21.5b	88.0ab	61
EXP80415A	12.5	245a	7.5c	71.7c	53
EXP80415A	25.0	245a	1.5c	72.6c	67
EXP80415A	50.0	221b	3.2c	75.0c	52
Check	--	195abc	49.5a	97.8a	57
ANOVA P•0.05		22	9.8	11.4	ns

* Accumulative counts June 10, 14, 17, 21, 25, 28, July 2, 5, 8, 12, 16, 18, and 23.

** Means followed by the same letter are not significantly different (P•0.05; LSD test).

PMR REPORT # 026 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 84100737

CROP: Onions, cv. Fortress
PEST: Onion maggot, *Delia antiqua* (Meig.); onion smut, *Urocystis cepulae* Frost

NAME AND AGENCY:

RITCEY G and HARRIS C R
Department of Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1
Tel: (519) 824-4120, ext. 3333 **Fax:** (519) 837-0442
E-mail: cgagnon@evbhort.uoguelph.ca
MACDONALD M R and JANSE S
Ontario Ministry of Agriculture, Food and Rural Affairs, Muck Research Station, Kettleby, ON, L0G 1J0
Tel: (416) 775-3783 **Fax:** (416) 775-4546 **E-mail:** mcdonam@gov.on.ca

TITLE: PESTICIDES FOR ONION MAGGOT CONTROL - PRECISION SEEDING

MATERIALS: LORSBAN 15 G (chlorpyrifos), AZTEC 2.1 G (phosetbupirin 2.0% + cyfluthrin 0.1%), GOVERNOR 75 WP (cyromazine), PRO GRO (carbathiin 30% + thiram 50%).

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates. Commercial custom-coated PRO GRO and GOVERNOR treated seed were provided by the Asgrow Seed Co. The seed treatment GOVERNOR was applied at the rate of 50g AI/kg of seed. The granular formulations were applied using a Stan-Hay precision seeder in a bed of four double rows 24 m long on May 9, 1996. Each bed had an untreated row and the three remaining rows had insecticde-treated seed with or without a granular treatment. On May 30 an assessment of initial stand was based on the number of plants in each of two, 2-m lengths in each row. The designated segments for the assessment of the first generation of onion maggot were checked twice weekly from June 10 to July 18, and damaged plants were counted and removed. On July 22, all plants were pulled from the same two, 2-m segments in each row and plants examined for maggot damage. At the end of the second and third generation, all plants were pulled from the designated two, 2-m lengths in each row and plants were examined for maggot damage. On October 1, 5 m of onions of each row were harvested for yield. On June 27 and July 16, 50 plants with four replicates were removed to determine smut infection. The plants were rinsed with water to remove adhering dirt and the bulb was examined visually for smut symptoms.

RESULTS: Data are presented in Table 1.

CONCLUSION: The registered seed treatment GOVERNOR alone and in combination with furrow treatments was effective in controlling the first generation of the onion maggot (Table 1). The LORSBAN granular treatment was not as effective as the unregistered granular insecticide AZTEC. By the end of the second and third generation the accumulative damage of the onion maggot had increased for all treatments. The stand loss was also attributed to extremely high onion smut infection.

Table 1. Initial stand, percent maggot damage, percent stand loss, and yield following the indicated granular and seed treatments at seeding.

Treatments			Initial plant count/ 6 m row	% Maggot damage*	% Stand loss**		Yield (kg/ha x 10)
Granular	Rate kg AI/ha	Seed		Gen 1	Gen 1&2	Gen 1,2,&3	
Check	0	----	193ab***	31.9ab	64.1ab	68.6a	67.2e
LORSBAN	1.1	----	192ab	15.0c	51.5cd	44.7fg	104.4a
LORSBAN	2.2	----	188abc	12.3cd	51.8cde	54.0cdef	81.0bcde
LORSBAN	4.5	----	199a	14.7c	52.8cd	55.3bcdef	90.5abc
Check	0	----	199a	31.8ab	64.8ab	65.5ab	70.6de
AZTEC	0.25	----	196ab	9.2cde	46.9de	46.3fg	93.6ab
AZTEC	0.50	----	186abcd	3.4de	37.0ef	41.5g	101.4a
----		GOVERNOR	194ab	3.4de	54.3abcd	58.3abcde	80.8bcde
Check	0	----	191abc	40.0a	66.3a	62.7abc	79.9bcde
LORSBAN	1.1	GOVERNOR	173d	2.2e	36.7ef	47.9efg	89.2bcd
LORSBAN	2.2	GOVERNOR	193ab	1.7e	27.1f	39.9g	93.8ab
----		GOVERNOR	191abc	2.2e	45.7de	50.9defg	96.5ab
Check	0		192ab	26.7b	60.4abc	64.8abc	71.4cde
AZTEC	0.25	GOVERNOR	178cd	1.5e	47.9cde	61.3abcd	86.7abcd
AZTEC	0.5	GOVERNOR	184bcd	1.1e	37.5ef	47.4efg	101.7a
----		GOVERNOR	191abc	2.6e	38.1abcd	57.7abcde	89.3abc
ANOVA P•0.05			14	9.0	13.4	10.8	18.5
% Onion smut:		June 27		July 16			
Regular seed:		31		41			
Trigard treated seed:		38		47			

* Accumulative counts June 10, 14, 17, 21, 25, 28, July 2, 5, 8, 12, 16, 18, and 24.

** 1st and 2nd generation final count August 26.

*** Means followed by the same letter are not significantly different (P•0.05; LSD test).

PMR REPORT # 027 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 84100737

CROP: Onions, cv. Benchmark
PEST: Onion thrips, *Thrips tabaci* Lind.

NAME AND AGENCY:
RITCEY G and HARRIS C R
Department of Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1
Tel: (519) 824-4120, ext. 3333 **Fax**: (519) 837-0442
E-mail: cgagnon@evbhort.uoguelph.ca

TITLE: INSECTICIDE FOLIAR TREATMENT TO CONTROL THRIPS ON ONIONS

MATERIALS: CYMBUSH 250 EC (cypermethrin), MATADOR 120 CSO (lambda-cyhalothrin), MATADOR 120 EC (lambda-cyhalothrin), NAF (spinosad).

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. Onions were planted with a Stan-Hay precision seeder in a bed of four double rows. The experimental plot was arranged in a randomized complete design. The plots were two beds, 7 m long, replicated four times. The treatments were applied at 500 L of liquid per/ha with a tractor-mounted sprayer at 600 kPa on August 26, 1996. The thrips population was assessed by examining ten onion plants in each plot. Nymphs and adults were counted on each leaf and the leaf was stripped to count thrips in the leaf axil.

RESULT: Results are presented in the Table below.

CONCLUSIONS: Three days after application, CYMBUSH and both formulations of MATADOR were more effective in controlling the nymphal and adult population. Eight days after application NAF 85 was not effective in controlling the onion thrips population.

Table 1. Mean number of nymphal (N) and adult (A) thrips per plant after insecticide foliar application.

				Mean number of thrips per plant Days after application			
	Rate	Pre-application		3		8	
Treatments	g/AI/ha	N	A	N	A	N	A
1 CYMBUSH 250EC	70	4.1	0.3	1.1b	0.1b	6.8	0.5
2 NAF 85	100	1.0	0.2	2.4b	0.1b	11.7	1.1
3 NAF 85	200	0.7	0.4	7.2ab	0.6ab	36.3	2.1
4 NAF 85	400	7.8	0.5	5.0ab	0.3ab	30.1	1.4
5 MATADOR 120CSO	10	0.2	1.0	3.7b	0.1b	14.5	0.8
6 MATADOR 120 EC	10	4.8	2.0	1.4b	0.0b	11.7	0.5
7 Control	---	9.4	1.4	12.9a	0.9a	34.2	2.7
ANOVA P•0.05		ns	ns	8.7	0.7	ns	ns

* Means followed by the same letter are not significantly different (P•0.05; LSD test).

PMR REPORT # 028 **SECTION B: INSECTS OF VEGETABLE AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Cooking onion, cv. Prince
PEST: Onion maggot (OM), *Delia antiqua* (Meigen)

NAME AND AGENCY:
TOLMAN J H and McFADDEN G A
Agriculture and Agri-Food Canada, Pest Management Research Centre, 1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 ext. 232 **Fax**: (519) 457-3997 **E-mail**: tolmanj@em.agr.ca

TITLE: **EVALUATION OF SEED COATINGS FOR CONTROL OF ONION MAGGOT ATTACKING COOKING ONIONS IN ORGANIC SOIL**

MATERIALS: REGENT 200 F (fipronil), LORSBAN 480 E (chlorpyrifos), GOVERNOR 75 WP (cyromazine), PRO GRO (carbathiin + thiram).

METHODS: Commercial film seed coatings, containing insecticide + PRO GRO, were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. All seed was planted at the London Research Farm on May 1 in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. All treatments were replicated three times in a randomized complete block design. On May 31 a total of 250 OM eggs from an insecticide-susceptible strain, originally collected on the Thedford Marsh (TM), were buried 1 cm deep beside one onion row in each plot. The infested row length was delineated by stakes and the number of onion plants was counted. Infestations to remaining rows were repeated on June 3 and 5. Surviving onion plants were counted 4 weeks after each infestation and the percent loss calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Untransformed data are presented.

RESULTS: See Table 1. below.

CONCLUSIONS: For all infestations, numbers of onion seedlings remaining after 4 weeks were significantly higher when the seed coating included an insecticide. Although not statistically significant, more onions were destroyed by feeding OM following Infestations II and III when seed was coated with GOVERNOR than when seed was coated with either REGENT or LORSBAN.

Table 1. Effect of seed coatings on onion stand loss due to onion maggot.

No.	Insecticide in Seed Coating	Rate (g AI/ kg seed)	Mean % Onion Loss after Indicated Infestation Infest. I (May 31)	Infest. II (Jun 2)	Infest. III (Jun 5)
1	GOVERNOR 75 WP	50.0	5.6 b*	10.0 b	27.1 b
2	LORSBAN 480 E	50.0	2.4 b	7.5 b	7.9 b
3	REGENT 200 F	25.0	4.5 b	7.7 b	8.2 b
4	CONTROL	---	40.2 a	73.7 a	80.2 a

* Means within a column followed by the same letter are not significantly different (P•0.05) as determined by Duncan's New Multiple Range Test.

RAPPORT # 029 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures,
MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: NOVODOR ET KRYOCIDE UTILISÉS AVEC BOND (ADJUVANT) CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.

PRODUITS: KRYOCIDE (fluoaluminate de sodium, 96%); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%); BOND (adhésif, 0,25% v/v).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 24 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements préconisés pour NOVODOR et KRYOCIDE étaient les suivants respectivement: 1. NOVODOR, 2. NOVODOR + BOND, 3. TÉMOIN (sans traitement); 1. KRYOCIDE, 2. KRYOCIDE + BOND, 3. TÉMOIN (sans traitement). La première intervention a été effectuée 7 jours après l'apparition des petites larves (10-30% d'éclosion des oeufs; 100% L1 + L2) et les intervalles entre les traitements varient de 5 à 8 jours. Les insecticides ont été pulvérisés pour chacun des traitements le 27 juin et les 2, 10 et 18 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). Les interventions ont été effectuées en dépit des prévisions de pluie, afin de mieux vérifier la performance de l'adjuvant BOND à augmenter l'adhérence du produit sur le feuillage en période de lessivage très accentuée en juillet. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 12 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 21 août 1996.

RÉSULTATS: Voir les tableaux 1 (NOVODOR) et 2 (KRYOCIDE) ci-dessous.

CONCLUSIONS: L'ajout de certains adjuvants à un produit vise à favoriser son adhérence sur le feuillage lors de précipitations et ainsi maintenir son efficacité. Dans cette optique, BOND (adjuvant) a été combiné à NOVODOR et KRYOCIDE au cours de la saison 1996 qui s'est manifestement bien prêtée à cette étude, puisque les précipitations ont été très fréquentes en juillet. Dans l'ensemble, les résultats (densités, dommages et rendements) indiquent que l'ajout de BOND à NOVODOR et à KRYOCIDE n'a pas significativement augmenté l'efficacité des produits (Tableaux 1 et 2). Toutefois, on a noté une légère diminution des densités larvaires du traitement NOVODOR avec BOND (significative test t) après la pulvérisation du 2 juillet qui a été suivie de fortes précipitations les jours suivants. Cette tendance n'a pas été observée avec KRYOCIDE qui même avec l'addition d'un adjuvant n'a pas permis d'augmenter son adhérence sur le feuillage. Comparativement à NOVODOR (solution liquide), KRYOCIDE est un produit en poudre mouillable qui serait plus facilement sensible au délavage par la pluie. Dans d'autres projets, nous avons observé en 1996 pour KRYOCIDE une efficacité légèrement inférieure à celle de 1994 et 95, probablement attribuable aux délavages fréquents en juillet. Pour tous les traitements avec NOVODOR et KRYOCIDE, les indices de dommage aux plants ont tout de même été très faibles et stables pendant toute la saison avec aucune différence significative observée au niveau des rendements. Les rendements avec NOVODOR et KRYOCIDE sont toutefois significativement différents de ceux obtenus chez les Témoins. Les indices de dommage chez les Témoins sont demeurés bas et stables pendant les trois premières semaines de juillet en raison d'une saison fraîche et pluvieuse. Cependant, l'incidence de la défoliation sur les rendements est principalement attribuable à un retour à des conditions climatiques de saison plus normales vers la fin juillet et en août avec des indices de dommage supérieurs à 4,0 principalement en période de floraison. Bien que l'incidence du doryphore en 1996 a été inférieure aux saisons précédentes, NOVODOR et KRYOCIDE ont tout de même été relativement très efficaces en dépit des conditions particulières rencontrées cette saison. Ainsi, l'ajout de BOND n'a pas eu d'impact significatif sur ces produits. Sans BOND, les formulations de KRYOCIDE et plus particulièrement de NOVODOR seraient relativement très stables.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement		Population larvaire					Dommage*			Rendement
Insecticide	Dose (p.c./ha)	juin		juillet			juillet		août	(t/ha)
			26	05	12	31	02	10	23	05
1. NOVODOR	7,0 L	1,0**	2,7b	2,4b	4,9b	1,0	1,0b	1,0b	1,0b	42,7a
2. NOVODOR + BOND	7,0 L + 0,25% v/v	1,0	2,2b	2,9b	3,8b	1,0	1,0b	1,0b	1,0b	42,8a
3. TÉMOIN	---	2,7	25,8a	44,1a	9,9a	1,0	1,8a	4,8a	5,0a	29,6b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

Table 2. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juin	juillet				Dommage[*] juillet		août	Rendement (t/ha)
			26	05	12	31	02	10	23	05
1. KRYOCIDE	11,0 L	2,3[**]	3,4b	2,1b	2,2b	1,0	1,0b	1,0b	1,0b	42,6a
2. KRYOCIDE + BOND	7,0 L + 0,25% v/v	1,1	3,4b	3,3b	3,2b	1,0	1,0b	1,0b	1,0b	42,8a
3. TÉMOIN		2,7	25,8a	44,1a	9,9a	1,0	1,8a	4,8a	5,0a	29,6b

[*] Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: voir tableau 1.

[**] Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 030 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: **EFFICACITÉ DE FIPRONIL CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.**

PRODUITS: EXP60115A (fipronil, 200 g/L); ADMIRE 240FS (imidacloprid).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements étaient les suivants: 1. ADMIRE foliaire; 2. ADMIRE sol; 3. fipronil; 4. TÉMOIN (sans traitement). Le taux d'éclosion des masses d'oeufs étaient de 43% (100% L1 + L2) lors de la première intervention et les intervalles entre les autres traitements varient de 7 à 10 jours. ADMIRE au sol a été appliqué lors de la plantation, tandis que les autres insecticides ont été pulvérisés le 27 juin et les 5 et 12 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 15 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'efficacité de l'insecticide fipronil a été comparé à ADMIRE appliqué sur le feuillage ou au sol lors de la plantation. L'ensemble des résultats (densités, dommages et rendement) indiquent que ces insecticides se sont avérés très performant comparativement au Témoin, sans traitement (Tableau 1). En regard de toutes nos évaluations de densités, fipronil a été plus efficace contre les adultes qu'ADMIRE foliaire et significativement plus efficace qu'ADMIRE au sol vers la fin de juillet contre les larves. De plus, ces deux insecticides sembleraient affecter le comportement de la ponte, puisque des masses d'oeufs ont été retrouvées plus fréquemment sur la face supérieure des feuilles. Pour fipronil et ADMIRE foliaire les densités larvaires sont demeurées très basses et significativement inférieures à ADMIRE au sol à la fin juillet. Il est à noter que la rémanence d'ADMIRE (au sol) diminue à partir de la troisième semaine de juillet et se traduit par une augmentation du dommage suite à une colonisation tardive des parcelles par des adultes printaniers et l'arrivée de masses d'oeufs et de larves. La protection du feuillage a été tout aussi valable avec ADMIRE foliaire. La saison fraîche et pluvieuse a réduit l'incidence du doryphore et le dommage est demeuré faible (•1,0) et stable durant la période de floraison, et ce, même pour le Témoin (•2,0). En août, un retour à des conditions climatiques plus normales de saison a accentué le développement des larves et le dommage aux plants. Ainsi, l'indice de dommage chez le Témoin est passée de 2,0 à 6,0 du 5 au 12 août. Pour ADMIRE et fipronil, le dommage est demeuré sensiblement identique à celui observé le 5 août. Le rendement chez le Témoin a été très affecté comparativement à ADMIRE et fipronil. Pour ces insecticides, les rendements ne diffèrent pas significativement entre eux. En dépit d'un indice de dommage relativement faible et stable chez le Témoin en saison, l'incidence sur le rendement a tout de même été très significative avec une réduction d'environ 6,8 t/ha. Cela supporte de nouveau l'importance de bien protéger le feuillage pendant toute la saison et de maintenir des seuils d'interventions bas. Selon les conditions qui prévalaient en 1996, fipronil a été tout aussi performant qu'ADMIRE foliaire et ADMIRE au sol. Fipronil et ADMIRE, appliqués sur le feuillage, demeurent donc des produits plus rentables économiquement que des interventions strictement orientées au sol en début de saison. Dans un programme de lutte intégrée contre le doryphore, la performance de fipronil permettra d'associer stratégiquement son emploi à celui d'ADMIRE en saison.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juin 26	juillet 05	17	30	Dommage* juillet 05	19	26	août 05	Rendement (t/ha)
1. ADMIRE fol.	200 ml	0,6**	3,3b	0,0b	0,0c	0,0c	0,0c	0,0c	0,8b	45,8a
2. ADMIRE sol	850 ml	0,0	0,0c	0,4b	3,8b	0,0c	0,0c	1,0b	1,0b	47,1a
3. Fipronil	125 ml	0,4	3,8b	0,5b	0,5c	0,5b	0,8b	1,0b	1,0b	46,3a
4. TÉMOIN	---	0,5	6,2a	23,2a	15,3a	1,0a	2,0a	2,0a	2,0a	39,7b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 031 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Email**: rmduches@riq.qc.ca
Télécopieur: (418) 644-6855

TITRE: EFFICACITÉ DE SPINOSAD A DIFFÉRENTES CONCENTRATIONS CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.

PRODUITS: SPINOSAD 480 (NAF85); ADMIRE 240FS (imidacloprid).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements (p.c./ha) étaient les suivants: 1. ADMIRE foliaire (200,0 ml); 2. ADMIRE sol (850,0 ml); 3. SPINOSAD (52,1 ml); 4. SPINOSAD (78,1 ml); 5. SPINOSAD (104,2 ml); 6. SPINOSAD (208,3 ml); 7. TÉMOIN. Le taux d'éclosion des masses d'oeufs étaient de 43% (100% L1 + L2) lors de la première intervention et les intervalles entre les autres traitements varient de 7 à 10 jours. L'ADMIRE au sol a été appliqué lors de la plantation, tandis que les autres insecticides ont été pulvérisés le 27 juin et les 5 et 12 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 15 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août 1996.

RÉSULTATS: Voir les tableaux 1 (SPINOSAD et ADMIRE) et 2 (SPINOSAD à différentes concentrations) ci-dessous.

CONCLUSIONS: Durant la saison 1996, l'insecticide SPINOSAD utilisé à différentes doses, a été comparé à ADMIRE (foliaire et sol) afin d'en évaluer son efficacité. Les résultats (densités, dommages et rendement) indiquent qu'ADMIRE et SPINOSAD se sont avérés plus performants que le Témoin, sans traitement (Tableau 1). De plus, ces deux insecticides sembleraient affecter le comportement de la ponte, puisque des masses d'oeufs ont été observées plus fréquemment sur la face supérieure des feuilles. Jusqu'à la mi-juillet, SPINOSAD a eu une performance semblable à ADMIRE foliaire, mais significativement plus faible qu'ADMIRE au sol. Par la suite, SPINOSAD, tout comme ADMIRE au sol, montre une efficacité inférieure à ADMIRE foliaire. De façon générale, SPINOSAD utilisé à doses élevées (104,2 et 208,3 ml) a davantage réduit les populations larvaires que les plus faibles doses (52,1 et 78,1 ml), (Tableau 1 et 2). En fin de saison, SPINOSAD (208,3 ml) présente significativement moins de grosses larves (62,7% L3 + L4) que les autres doses (92,3 à 99,0% L3 + L4). La saison très pluvieuse a réduit l'incidence du doryphore et le dommage est demeuré faible et stable (•1,0) durant la floraison, à un niveau qui n'a pas affecté les rendements pour les parcelles traitées avec ADMIRE et SPINOSAD. Le dommage est équivalent d'une dose à l'autre et ne diffère pas significativement (Tableau 2). Il se compare en fin de saison à ceux obtenus avec ADMIRE (Tableau 1). A part la dose de 208,3 ml pour SPINOSAD, les rendements sont comparables pour tous les traitements insecticides. Cette différence est principalement attribuable à des conditions variables au niveau du champ. Comme l'incidence du doryphore a été relativement faible en 1996, il serait sans doute plus sécuritaire d'utiliser SPINOSAD à des doses de 104,2 à 208,3 ml. A ces doses, l'incidence sur les densités larvaires serait plus stable et offrirait une meilleure protection du feuillage. Selon les conditions expérimentales de 1996, SPINOSAD est un insecticide comparable à ADMIRE foliaire et ADMIRE au sol et peut définitivement être utilisé en association avec ADMIRE et d'autres moyens dans un programme de lutte intégrée.

Table 1. SPINOSAD et ADMIRE: Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juin 26	juillet 05	17	30	Dommage* juillet 05	19	26	août 05	Rendement (t/ha)
1. ADMIRE (foliaire)	200,0 ml	0,6**	3,3b	0,0c	0,0e	0,0c	0,0c	0,0c	0,8b	45,8ab
2. ADMIRE (sol)	850,0 ml	0,0	0,0c	0,4c	3,8bc	0,0c	0,0c	1,0b	1,0b	47,1a
3. SPINOSAD	52,1 ml	0,4	4,1ab	2,1b	3,9bc	0,8ab	1,0b	1,0b	1,0b	45,3ab
4. SPINOSAD	78,1 ml	0,4	4,6ab	1,0bc	5,1b	1,0a	1,0b	1,0b	1,0b	46,0ab
5. SPINOSAD	104,2 ml	0,0	4,4ab	0,2c	2,6cd	0,5b	1,0b	1,0b	1,0b	46,9a
6. SPINOSAD	208,3 ml	0,0	2,3bc	1,1bc	2,1d	0,8ab	1,0b	1,0b	1,0b	43,3b
7. TÉMOIN	---	0,5	6,2a	23,2a	15,3a	1,0a	2,0a	2,0a	2,0a	39,7c

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

Table 2. SPINOSAD à différentes concentrations: Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juin 26	juillet 05	17	30	Dommage* 05	juillet 19	26	août 05	Rendement (t/ha)
3. SPINOSAD	52,1 ml	0,4**	4,1ab	2,1b	3,9bc	0,8	1,0b	1,0b	1,0b	45,3ab
4. SPINOSAD	78,1 ml	0,4	4,6ab	1,0bc	5,1b	1,0	1,0b	1,0b	1,0b	46,0a
5. SPINOSAD	104,2 ml	0,0	4,4ab	0,2c	2,6cd	0,5	1,0b	1,0b	1,0b	46,9a
6. SPINOSAD	208,3 ml	0,0	2,3b	1,1bc	2,1d	0,8	1,0b	1,0b	1,0b	43,3b
7. TÉMOIN	---	0,5	6,2a	23,2a	15,3a	1,0	2,0a	2,0a	2,0a	39,7c

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: voir tableau 1.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 032 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures,
MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**:
rmduches@riq.qc.ca

TITRE: **ESSAI D'INSECTICIDES CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.**

PRODUITS: ADMIRE 240FS (imidacloprid); EXP60115A (fipronil, 200 g/L); NAF85 (spinosad, 480 g/L).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements sont les suivants: 1. ADMIRE foliaire; 2. ADMIRE sol; 3. fipronil; 4. spinosad; 5) TÉMOIN (sans traitement). Le taux d'éclosion des masses d'oeufs étaient de 43% (100% L1 + L2) lors de la première intervention et les intervalles entre les autres traitements varient de 7 à 10 jours. L'ADMIRE au sol a été appliqué lors de la plantation, tandis que les autres insecticides ont été pulvérisés le 27 juin et les 5 et 12 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 15 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'efficacité des insecticides fipronil et spinosad a été comparé à ADMIRE (foliaire et sol) lors des essais en 1996. Tous les insecticides se sont révélés significativement plus performants (densités, dommages et rendement) que le Témoin (Tableau 1). La saison particulièrement pluvieuse a réduit l'impact du doryphore comparativement à la saison 1995 qui a été beaucoup plus chaude. En effet, même un indice de dommage faible et stable (•2,0) pour le Témoin pendant la floraison a eu un impact significatif sur le rendement. Ceci traduit bien l'importance de très bien protéger le feuillage en maintenant des seuils d'interventions relativement bas en saison. Les insecticides ont tous été très performants contre les adultes, mais fipronil a semblé être un peu plus efficace. Pour tous les insecticides, les populations larvaires, composées principalement de petites larves (L1 + L2), ont été maintenues à des seuils très bas comparativement au Témoin. De plus, les densités larvaires observées avec ADMIRE foliaire, fipronil et spinosad ont été relativement similaires jusqu'à la mi-juillet. Puis, vers le 30 juillet, ADMIRE foliaire et fipronil ont eu une rémanence semblable et significativement plus longue qu'avec spinosad pour la troisième intervention. Avec seulement trois traitements, ADMIRE appliqué sur le feuillage a été tout aussi efficace et plus économique qu'ADMIRE au sol. Ce dernier à une dose de 850 ml, a été rémanent jusqu'à la mi-juillet. Par la suite, les densités et le dommage aux plants ont progressivement augmenté jusqu'en août. Le dommage a été légèrement plus élevé en début de saison pour les traitements fipronil et spinosad, sans toutefois affecter leur rendement respectif. La différence significative de rendement entre spinosad (208,3 ml) et ADMIRE au sol peut s'expliquer par des conditions variables au niveau du champ, puisqu'un rendement comparable a été obtenu avec une dose inférieure dans un autre projet. A part cette situation particulière, les rendements sont comparables pour tous les insecticides. Selon les conditions de 1996, fipronil et spinosad ont été tout aussi performants qu'ADMIRE foliaire et ADMIRE au sol pour la protection foliaire et les rendements obtenus. Ces insecticides demeurent donc des produits rentables économiquement et offrent de très bonnes possibilités dans un programme de lutte intégrée contre le doryphore de la pomme de terre.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	05	17	30	05	19	26	05	
1. ADMIRE (foliaire)	200,0 ml	0,6**	3,3b	0,0b	0,0d	0,0c	0,0c	0,0c	0,8b	45,8ab
2. ADMIRE (sol)	850,0 ml	0,0	0,0c	0,4b	3,8b	0,0c	0,0c	1,0b	1,0b	47,1a
3. Fipronil	125,0 ml	0,4	3,8b	0,5b	0,5d	0,5b	0,8b	1,0b	1,0b	46,3ab
4. Spinosad	208,3 ml	0,0	2,3bc	1,1b	2,1c	0,8ab	1,0b	1,0b	1,0b	43,3b
5. TÉMOIN	---	0,5	6,2a	23,2a	15,3a	1,0a	2,0a	2,0a	2,0a	39,7c

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures,
MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**:
rmduches@riq.qc.ca

TITRE: **ADMIRE AU SOL: RÉMANENCE ET INTERVENTIONS CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.**

PRODUITS: ADMIRE 240FS (imidacloprid); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 28 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les traitements (p.c./ha) étaient les suivants: 1. ADMIRE sol (250,0 ml) + NOVODOR (7,0 L); 2. ADMIRE sol (450,0 ml) + NOVODOR (7,0 L); 3. ADMIRE sol (650,0 ml); 4. ADMIRE sol (850,0 ml); 5. TÉMOIN (sans traitement). ADMIRE au sol a été appliqué lors de la plantation le 28 mai, tandis que le NOVODOR a été pulvérisés le 18 juillet, dès l'apparition de larves à un seuil d'environ 2 larves/plant (traitement 1 et 2) à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée régulièrement sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 15 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 26 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Différentes doses d'ADMIRE ont été appliquées au sol lors de la plantation, afin d'évaluer leur rémanence et la possibilité d'associer stratégiquement un insecticide foliaire tel que NOVODOR durant la saison. Les résultats indiquent (densités, dommages et rendement) que peu importe la dose d'ADMIRE au sol utilisée, l'efficacité est plus élevée que le Témoin, sans traitement (Tableau 1). ADMIRE au sol appliqué à de faibles doses (250,0 et 450,0 ml) a permis de retarder la colonisation hâtive en champs, mais les populations larvaires ont augmenté dès la mi-juillet avec respectivement 3,2 larves/plant (72,9% L1 + L2; 27,1% L3 + L4) et 1,9 larve/plant (98,7% L1 + L2; 1,3% L3 + L4) le 17 juillet. L'application foliaire de NOVODOR effectuée le 18 juillet, pour ralentir l'augmentation des densités larvaires, a toutefois été modérément efficace sans doute en raison des précipitations abondantes les jours suivants le traitement. En dépit de cela, l'utilisation d'un insecticide biologique ou de tout autre moyen d'intervention demeure très intéressante en association avec ADMIRE au sol, lorsque son usage en début de saison contre les adultes printaniers est totalement justifié. En juillet, la rémanence d'ADMIRE au sol à faibles doses (traitements 1 et 2) a été légèrement plus courte qu'à plus fortes doses (traitements 3 et 4). Par la suite, ADMIRE au sol, quelle que soit la dose, a progressivement perdu de son efficacité dès la troisième semaine de juillet. En 1996, probablement en raison des fortes précipitations en juillet, ADMIRE au sol aurait été moins rémanent comparativement à la saison 1995 qui a reçu très peu de pluie. En général, pour la période du 5 au 26 juillet, les indices de dommage aux plants avec ADMIRE sont très faibles (•1,0) et évoluent en regard des doses utilisées ainsi que de la durée de rémanence du produit. Ils sont par la suite très similaires et l'augmentation en août est principalement attribuable à la hausse des densités larvaires à la fin de juillet. Dans tous les cas, les indices de dommage aux plants sont significativement plus faibles que ceux du Témoin. Les rendements ne diffèrent pas significativement d'une dose à l'autre et sont d'environ 8 t/ha supérieurs à celui obtenu chez le Témoin, sans traitement. Malgré des indices de dommage aux plants chez le Témoin, relativement bas et stables, l'incidence très significatif sur le rendement démontre de nouveau l'importance d'une très bonne protection des plants en saison. L'application régulière à chaque saison d'ADMIRE au sol à de fortes doses n'est pas compatible avec un programme de lutte intégrée contre le doryphore. Toutefois, les résultats de cette étude sont dans l'ensemble intéressants, car ils suggèrent différentes possibilités d'utilisation d'ADMIRE. Ainsi, l'emploi d'ADMIRE au sol à de très faibles doses pourrait être acceptable s'il est associé obligatoirement à d'autres moyens de lutte en saison contre les larves. Des approches de lutte saisonnières à "multiples attaques" contribueraient davantage à réduire le développement de la résistance.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Dose p.c./ha	Population larvaire				Dommage*				Rendement (t/ha)
		juin	juillet			juillet			août	
		28**	08	17	30	05	17	26	05	
1. ADMIRE (sol) + NOVODOR	250,0 ml 7,0 L	0,0b	0,6b	3,2b	8,7b	0,0b	1,0b	1,0b	1,8b	43,9a
2. ADMIRE (sol) + NOVODOR	450,0 ml 7,0 L	0,0b	0,4b	1,9b	6,6c	0,3b	1,0b	1,0b	1,5b	43,3a
3. ADMIRE (sol)	650,0 ml	0,0b	0,3b	0,3b	4,9c	0,0b	0,0c	1,0b	1,3b	43,8a
4. ADMIRE (sol)	850,0 ml	0,0b	0,0b	0,3b	4,8c	0,0b	0,3c	1,0b	1,3b	43,0a
5. TÉMOIN	---	1,5a	12,6a	28,0a	19,5a	1,0a	2,0a	2,5a	3,3a	35,4b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 034 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: **EFFICACITÉ COMPARATIVE DE DEUX FORMULATIONS D'ADMIRE CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996**.

PRODUITS: ADMIRE 240FS et ADMIRE 70WP (imidacloprid); GUTHION 240EC (azinphos-méthyl); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements étaient les suivants: 1. ADMIRE WP (foliaire), 2. ADMIRE FS (foliaire), 3. ADMIRE FS (sol) + NOVODOR, 4. GUTHION, 5. TÉMOIN (sans traitement). La première intervention a été effectuée dès l'apparition des petites larves (10-30% d'éclosion des masses d'oeufs; 100% L1 + L2) et les intervalles entre les traitements varient de 6 à 9 jours. L'ADMIRE au sol a été appliqué lors de la plantation et le NOVODOR a été utilisé dès l'apparition des larves à un seuil d'environ 2 larves/plant. Les insecticides foliaires ont été pulvérisés le 27 juin et le 5 juillet (traitements 1, 2 et 4), le 12 juillet (traitement 4) et le 18 juillet (traitements 3 et 4) à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 12 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 22 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: En 1996, l'efficacité d'une nouvelle formulation d'ADMIRE WP sous forme de poudre mouillable appliqué sur le feuillage a été comparée à ADMIRE FS commercial liquide (foliaire et au sol) et au GUTHION. Quelle que soit la formulation ou le type d'application utilisé, les résultats (densités, dommages et rendement) indiquent qu'ADMIRE est significativement plus efficace que le GUTHION et le Témoin (Tableau 1). Malgré les précipitions survenues peu après la pulvérisation du 5 juillet (26,5 mm), ADMIRE en poudre est très comparable à ADMIRE sous forme liquide. Avec seulement deux pulvérisations, ADMIRE (FS et WP) appliqué sur le feuillage a été tout aussi efficace et définitivement plus économique qu'ADMIRE au sol. Pour ce dernier, à une dose de 850,0 ml la rémanence du produit a été relativement très acceptable jusqu'à la mi-juillet; puis les densités et le dommage aux plants ont progressivement augmenté jusqu'en août. Bien qu'une intervention tardive avec NOVODOR est été effectuée le 18 juillet, la population larvaire était significativement plus élevée au début d'août pour le traitement ADMIRE au sol (6,8 larves/plant; 53,9% L1 + L2; 46,1% L3 + L4) comparativement à ADMIRE (FS et WP sur feuillage). Toutefois, les très fortes précipitations et les températures fraîches survenues après le traitement du 18 juillet pourraient expliquer la faible performance de NOVODOR. Avec quatre pulvérisations, le GUTHION n'a pas été très performant avec des résultats (densités, dommages et rendement) très comparables au Témoin. Cela démontre très certainement pour notre site d'expérimentation, un niveau de résistance du doryphore relativement élevé à ce produit. La température fraîche et les précipitations fréquentes en juillet ont réduit les densités larvaires durant la période de floraison tout en maintenant des indices de dommage très faibles pour les traitements avec ADMIRE (•1,0) et plus élevés avec le GUTHION et le Témoin (•3,5). Les rendements des deux formulations d'ADMIRE sont comparables entre eux et celui d'ADMIRE au sol. Ils sont toutefois significativement plus élevés que ceux obtenus avec GUTHION et le Témoin d'environ 7,6 t/ha. Bien qu'ADMIRE en poudre mouillable et liquide soient des produits très performants, leur association avec d'autres insecticides permettrait de retarder l'apparition de la résistance et serait plus intéressante dans un programme de lutte intégrée.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	05	15	30	05	18	26	05	
1. ADMIRE WP foliaire	68,6 g	1,8**	2,5b	0,1c	3,3c	0,0b	0,0c	1,0c	1,0d	44,1a
2. ADMIRE FS foliaire	200,0 ml	1,0	1,3b	0,2c	1,6c	0,0b	0,0c	1,0c	1,0d	44,1a
3. ADMIRE sol + NOVODOR	850,0 ml + 7,0 L	0,0	0,3b	2,7c	6,8ab	0,0b	0,8b	1,0c	1,5c	43,4a
4. GUTHION	1,7 L	0,9	13,2a	35,9b	5,2b	1,0a	3,3a	2,8b	2,8b	36,4b
5. TÉMOIN	---	1,3	12,5a	45,9a	7,2a	1,0a	3,0a	3,5a	3,8a	36,1b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 035 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: **ADMIRE: PÉRIODES OPTIMALES D'INTERVENTIONS CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.**

PRODUITS: ADMIRE 240FS (imidacloprid).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. La première intervention a été effectuée selon les stratégies de lutte suivantes: A. conventionnelle = 10-30% d'éclosion des masses d'oeufs: traitement 1, 100,0% L1 + L2; B. «boum d'éclosion» = 4, 6, 8 ou 10 jours après 10-30% d'éclosion des masses d'oeufs (traitements: 2, 100,0% L1 + L2; 3, 100,0% L1 + L2; 4, 99,1% L1 + L2; 0,9% L3

+ L4; 5, 94,5% L1 + L2, 5,5% L3 + L4). Les intervalles entre les traitements varient de 7 à 9 jours. Chacun des traitements ont reçu deux pulvérisations aux dates suivantes: 27 juin (traitement 1), 28 juin (traitement 2), 2 juillet (traitement 3), 3 juillet (traitement 4), 5 juillet (traitements 1, 2 et 5), 11 juillet (traitements 3 et 4) et le 12 juillet (traitement 5) à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). A noter que la première intervention de la stratégie A a été retardée de 2 jours à cause du vent. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 12 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 22 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Le choix judicieux du moment de la première intervention est déterminant pour une gestion efficace des populations larvaires du doryphore de la pomme de terre. En 1996, quelle que soit la stratégie préconisée, ADMIRE a été très efficace pour réduire les densités larvaires comparativement au Témoin (Tableau 1). La première intervention associée à la stratégie conventionnelle (A) et celles du «boum d'éclosion» (B) à des délais de 4 et 6 jours ont été effectuées contre les petites larves (100 % L1 + L2). Par contre, celles de la stratégie B à des délais de 8 et 10 jours l'ont été contre des populations larvaires plus élevées avec la présence de grosses larves dont 0,9% (L3 + L4) et 5,5% (L3 + L4) respectivement. A l'exception du délai de 10 jours, les densités larvaires pour la stratégie A ont été comparables à celles de la stratégie B jusqu'à la mi-juillet. En effet, le délai de 10 jours avant la première intervention a favorisé, tout comme pour le Témoin, le développement des densités larvaires le 5 juillet à un taux (15,5 larves/plant; 94,5% L1 + L2; 5,5% L3 + L4) significativement plus élevées que les autres traitements avec ADMIRE. Toutefois, un deuxième traitement plus tardif le 12 juillet a offert une meilleure rémanence d'ADMIRE en fin de saison comparativement à des délais plus courts (traitements 1 et 2). En 1996, la température fraîche et les précipitations fréquentes en juillet ont affecté les densités larvaires et le développement de l'insecte. Ces conditions ont aussi contribué à réduire les indices de dommage chez le Témoin à un niveau relativement bas et stable (de 3,0 à 3,5) durant la floraison comparativement aux saisons précédentes. Cependant, aucune différence significative entre les rendements pour les traitements avec ADMIRE n'a été observée, et ce, quelle que soit la stratégie utilisée. Les rendements sont toutefois significativement plus élevés que celui du Témoin d'environ 7,3 t/ha. En 1996, seulement deux applications d'ADMIRE ont été nécessaires et les délais de 6 et 8 jours ont été les plus sécuritaires en offrant une protection mieux répartie durant la saison. Pour sa part, le délai de 10 jours s'est révélé tout de même très acceptable en 1996. Son emploi serait cependant plus risqué lors de saison où les densités larvaires sont plus élevées et le développement de l'insecte plus rapide. En présence de conditions saisonnières différentes et de densités larvaires plus élevées, le recours, si nécessaire, à un troisième traitement en association avec un autre produit serait plus conforme à une approche de lutte intégrée. De nouveau cette étude en 1996, démontre la possibilité d'utiliser la stratégie «boum d'éclosion» contre le doryphore de la pomme de terre avec un délai de 6 à 9 jours pour initier la date de la première intervention. Cela est applicable à ADMIRE ou à tout autre moyen de lutte performant.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide	Stratégie/ délai (jours)	Population larvaire juin 26	juillet 05	15	30	Dommage* juillet 05	18	26	août 05	Rendement (t/ha)
1. ADMIRE**	A	1,0***	1,3c	0,2b	1,6bc	0,0c	0,0c	1,0b	1,0b	44,1a
2. ADMIRE	B/4	1,2	2,9c	0,4b	2,5b	0,5b	0,0c	1,0b	1,0b	44,0a
3. ADMIRE	B/6	1,5	1,0c	0,5b	0,3d	0,8ab	0,0c	0,5b	1,0b	44,0a
4. ADMIRE	B/8	0,1	2,7c	0,8b	0,9cd	1,0a	0,0c	0,5b	1,0b	43,3a
5. ADMIRE	B/10	0,8	15,5a	0,8b	0,1d	1,0a	0,8b	0,5b	0,8b	41,7a
6. TÉMOIN	---	1,3	12,5b	45,9a	7,2a	1,0a	3,0a	3,5a	3,8a	36,1b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Doses: ADMIRE, 200 ml p.c./ha.

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 036 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: **ADMIRE EN ASSOCIATION AVEC NOVODOR: PÉRIODES OPTIMALES D'INTERVENTIONS CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.**

PRODUITS: ADMIRE 240FS (imidacloprid); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 27 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. La première intervention a été effectuée selon les stratégies de lutte suivantes: A. conventionnelle = 10-30%

d'éclosion des masses d'oeufs (traitement 1, 100,0% L1 + L2); B. «boum d'éclosion» = 6 jours après 10-30% d'éclosion des masses d'oeufs (traitements 2, 100,0% L1 + L2; 3, 100,0% L1 + L2). ADMIRE au sol (traitement 4) a été appliqué lors de la plantation et l'insecticide biologique NOVODOR a été utilisé dès l'apparition des larves à un seuil d'environ 2 larves/plant. Les traitements foliaires ont été pulvérisés selon les dates suivantes: le 27 juin (traitement 1), le 2 juillet (traitements 2 et 3), le 5 juillet (traitement 1), le 11 juillet (traitement 2 et 3) et le 18 juillet (traitement 3 et 4) à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défané le 12 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 22 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Dans l'optique d'une approche plus durable et d'une lutte intégrée, ADMIRE (au sol ou sur le feuillage) en association avec un insecticide biologique a été comparé à ADMIRE foliaire employé seul, selon différentes stratégies d'interventions. Les densités larvaires avec ADMIRE foliaire pour les deux stratégies (A et B) sont demeurées faibles et stables jusqu'à la mi-juillet. En raison de son traitement hâtif, ADMIRE (stratégie A) a significativement perdu de son efficacité vers la fin de juillet avec des densités larvaires à la hausse. Comparativement aux autres traitements, l'association NOVODOR/NOVODOR/ADMIRE a été significativement moins efficace lors des deux premières interventions avec une population larvaire atteignant le 15 juillet 12,6 larves/plant (66,5% L1 + L2; 33,5% L3 + L4). Cependant, la $3^{\text{ième}}$ pulvérisation avec ADMIRE a permis de réduire les populations en fin de saison à un niveau similaire à la stratégie B et significativement plus faible que la stratégie A et ADMIRE au sol. L'ajout de NOVODOR au traitement ADMIRE au sol (850 ml), lorsque ce dernier est devenu moins rémanent, n'a pas permis de réduire les populations larvaires en fin de saison (6,8 larves/plant; 53,9% L1 + L2; 46,1% L3 + L4) à un seuil similaire aux autres traitements. De très fortes précipitations survenues après le traitement du 18 juillet ont sûrement contribué à réduire la performance de NOVODOR et un second traitement aurait été nécessaire. Avec seulement deux applications, ADMIRE appliqué sur le feuillage (stratégie A et B) a été tout aussi efficace et plus économique qu'ADMIRE au sol. En 1996, la saison fraîche et pluvieuse en juillet a maintenu le dommage à des indices très faibles pour les traitements insecticides (•1,0) et relativement stables (de 3,0 à 3,5) pour le Témoin durant la période de floraison. En dépit d'indices de dommage plus faibles que les saisons précédentes, le Témoin présente toutefois un rendement significativement plus faible que ceux obtenus avec les insecticides d'environ 7,4 t/ha. Les rendements ne diffèrent pas significativement entre les traitements insecticides. Bien que l'utilisation unique d'ADMIRE est donné une très bonne efficacité, l'association avec NOVODOR, tout en obtenant des rendements semblables, contribuerait sûrement à réduire la résistance du doryphore de la pomme de terre et serait plus conforme à une gestion intégrée des insecticides dans la perspective d'une approche durable contre le doryphore de la pomme de terre.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement		Population larvaire				Dommage[*]				Rendement
Insecticide[**]	Stratégie/ délai (jours)	juin 26	juillet 05	15	30	juillet 05	18	26	août 05	(t/ha)
1. ADMIRE fol.	A/-	1,0[***]	1,3c	0,2c	1,6b	0,0b	0,0c	1,0b	1,0c	44,1a
2. ADMIRE fol.	B/6	1,5	1,0c	0,5c	0,3c	0,8a	0,0c	0,5c	1,0c	44,0a
3. NOV/NOV/AD	B/6	1,2	5,1b	12,6b	0,4c	1,0a	1,0b	1,0b	1,0c	42,7a
4. ADMIRE sol + NOVODOR	---	0,0	0,3c	2,7c	6,8a	0,0b	0,8b	1,0b	1,5b	43,4a
5. TÉMOIN	---	1,3	12,5a	45,9a	7,2a	1,0a	3,0a	3,5a	3,8a	36,1b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Doses: ADMIRE foliaire, 200 ml p.c./ha; ADMIRE sol, 850 ml p.c./ha; NOVODOR, 7,0 L p.c./ha.

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

RAPPORT # 037 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
DUCHESNE R-M et GOULET B
Centre de recherche et d'expérimentation en régie et protection des cultures, MAPAQ, 2700, rue Einstein, Sainte-Foy, Québec, G1P 3W8
Tél: (418) 644-2156 **Télécopieur**: (418) 644-6855 **Email**: rmduches@riq.qc.ca

TITRE: ADMIRE EN ASSOCIATION AVEC NOVODOR ET KRYOCIDE CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1996.

PRODUITS: ADMIRE 240FS(imidacloprid); KRYOCIDE(fluoaluminate de sodium 96%);NOVODOR FC(endotoxine-delta -*Bacillus thuringiensis* v.*tenebrionis*, 3,0%).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 28 mai 1996 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les séquences de pulvérisation des insecticides étaient les suivantes selon les traitements: 1. ADMIRE/ADMIRE/ ADMIRE; 2. ADMIRE/NOVODOR/ADMIRE; 3. NOVODOR/NOVODOR/ADMIRE; 4. NOVODOR/

KRYOCIDE/ADMIRE; 5. ADMIRE/KRYOCIDE/ADMIRE; 6. KRYOCIDE/KRYOCIDE/ADMIRE; 7. NOVODOR/ADMIRE/KRYOCIDE; 8. TÉMOIN (sans traitement). Le taux d'éclosion des masses d'oeufs étaient de 43% (100% L1 + L2) lors de la première intervention et l'intervalle entre les traitements est de 7 jours. Ces insecticides ont été appliqués le 28 juin et les 5 et 12 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 15 août avec du RÉGLONE (diquat 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 27 août 1996.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Différents scénarios ont été évalués durant la saison 1996 (Tableau 1) en regard de l'association d'ADMIRE foliaire avec un insecticide biologique (NOVODOR) et un insecticide chimique (KRYOCIDE). Considérant que KRYOCIDE est généralement plus efficace contre les grosses larves comparativement à NOVODOR, les scénarios retenus tiennent compte du moment opportun maximisant leur efficacité respective contre le doryphore de la pomme de terre. L'utilisation d'ADMIRE, NOVODOR ou KRYOCIDE pour la première intervention contre les petites larves ne diffère pas significativement. Lors de la $2^{\text{ième}}$ application, KRYOCIDE s'est révélé moins efficace qu'ADMIRE et NOVODOR, principalement lorsqu'il a été précédé de NOVODOR (traitement 4). A noter que d'importantes précipitations (10 mm) enregistrés dans la soirée suivant le $2^{\text{ième}}$ traitement ont probablement lessivé davantage KRYOCIDE (poudre mouillable) comparativement à ADMIRE et NOVODOR (solutions liquides). L'usage du KRYOCIDE (traitement 7) pour la dernière pulvérisation principalement contre les grosses larves (L3 + L4) a été aussi efficace qu'ADMIRE (traitements 1 à 6), mais a perdu progressivement de l'efficacité à la fin de juillet avec 1,3 larves/plant (26,9% L1 + L2; 73,1% L3 + L4). Cette situation résulte d'une rémanence plus longue d'ADMIRE comparativement à KRYOCIDE. ADMIRE associé avec NOVODOR (traitements 2 et 3) ou KRYOCIDE (traitements 5 et 6) est relativement comparable à ADMIRE utilisé seul. L'association des trois produits pour les séquences NOVODOR/KRYOCIDE/ADMIRE et NOVODOR/ADMIRE/KRYOCIDE s'est révélée un peu moins efficace que les autres traitements. Aucun dommage aux plants n'a été observé en juillet pour la séquence ADMIRE/ADMIRE/ADMIRE, tandis que les autres traitements présentaient des indices très faibles (•1,0) certainement sans impact sur le rendement. Même si le dommage pour le Témoin est demeuré faible (•2,3) et relativement stable durant la floraison, l'incidence sur le rendement a été très significative avec une baisse de rendement d'environ 5,0 t/ha. Cette diminution associée à des indices relativement bas démontre l'importance de maintenir une protection adéquate des plants en saison. Les rendements de toutes les associations évaluées ne diffère pas entre eux. Même si l'utilisation unique d'ADMIRE présente une efficacité plus stable, l'association avec NOVODOR et KRYOCIDE demeure plus rentable dans la perspective d'un programme de lutte intégrée contre le doryphore. Cette approche permet de réduire l'incidence de la résistance de l'insecte non seulement à ADMIRE, mais à l'un et l'autre des produits. Dans cette perspective d'autres moyens de lutte, autres que NOVODOR et KRYOCIDE, peuvent aussi être associés à ADMIRE. Avec NOVODOR et KRYOCIDE, ADMIRE devrait être utilisé, préférentiellement en dernier comme deuxième ou troisième traitement selon la saison.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, saison 1996.

Traitement Insecticide**	Population larvaire				Dommage*				Rendement (t/ha)
	juin	juillet			juillet			août	
	27	05	11	31	05	19	26	05	
ADMIRE/ADMIRE/ADMIRE	1,0***	3,4ab	0,1c	0,0c	0,0b	0,0d	0,0d	1,0b	44,4a
ADMIRE/NOVODOR/ADMIRE	0,8	3,6ab	0,9c	0,2c	0,0b	0,0d	0,8bc	1,0b	44,5a
NOVODOR/NOVODOR/ADMIRE	0,2	3,9ab	1,6c	0,1c	1,0a	1,0b	0,5c	1,0b	44,7a
NOVODOR/KRYOCIDE/ADMIRE	0,9	4,8ab	3,8b	0,5bc	1,0a	1,0b	1,0b	1,0b	43,8a
ADMIRE/KRYOCIDE/ADMIRE	0,4	1,1b	0,3c	0,6bc	0,0b	0,0d	0,8bc	1,0b	44,1a
KRYOCIDE/KRYOCIDE/ADMIRE	0,4	3,1ab	2,0bc	0,6bc	1,0a	1,0b	0,8bc	1,0b	43,4a
NOVODOR/ADMIRE/KRYOCIDE	0,0	3,5ab	0,3c	1,3b	0,0b	0,5c	1,0b	1,0b	43,5a
TÉMOIN	1,4	6,0a	16,3a	13,6a	1,0a	2,3a	2,0a	2,8a	39,1b

* Évaluation visuelle par parcelle: indice de défoliation (Indice «Boiteau») de 0 à 8: (0) pas de défoliation; (1) 2-60% des plantes avec folioles légèrement endommagés; (1.5) > de 60% des plantes avec folioles légèrement endommagées; (2) 2% des plantes avec • une feuille composée défoliée à • 50%; (3) 2-9% des plantes avec • une tige défoliée à • 50%; (4) 10-24% des plantes avec • une tige défoliée à • 50%; (5) 25-49% des plantes avec • une tige défoliée à • 50%; (6) 50-74% des plantes avec • une tige défoliée à • 50%; (7) 75-99% des plantes avec • une tige défoliée à • 50%; (8) 100% des plantes avec • une tige défoliée à • 50%.

** Doses: ADMIRE 200 ml p.c./ha; NOVODOR 7,0 L p.c./ha; KRYOCIDE 11,0 kg p.c./ha. *** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

PMR REPORT # 038 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Buckthorn aphid, *Aphis nasturtii* Kaltenbach; Potato aphid, *Macrosiphum euphorbiae* (Thomas); green peach aphid, *Myzus persicae* (Sulzer)

NAME AND AGENCY:
BOITEAU G, DREW M E, and OSBORN W P L
Agriculture and Agri-Food Canada, Potato Research Centre, P.O. Box 20280, Fredericton, NB E3B 4Z7
Tel: (506) 452-3260 **Fax**: (506) 452-3316 **Email**: boiteaug@em.agr.ca

TITLE: **EFFECT OF ADMIRE ON THE SPREAD OF POTATO LEAFROLL VIRUS (PLRV)**
MATERIALS: ADMIRE 240 F (imidacloprid).

METHODS: Plots consisted of 12, 42 m long rows spaced 0.9 m apart. Treatments were arranged in a randomized block design with three replications. The Soil treatment consisted of an in-furrow application of ADMIRE at planting, the Foliar treatment received mid-season applications of foliar ADMIRE, and the Check treatment received no ADMIRE applications. Each block was divided into six sample blocks, six rows wide by 14 m long. Potatoes highly infected with PLRV were planted on June 2, 1996, at 0.46 m within row spacing. ADMIRE (0.03

g AI/m row) was applied in-furrow by a soil applicator with 80015 fan nozzles at planting. Foliar pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, and equipped with three D4-45 nozzles per row, with an application volume of 400 L/ha, and a speed of 6 kph. A plastic (4 mil) lined trench surrounding the 9 blocks, 8 m from the block edges was installed on June 3 to trap colonizing Colorado potato beetles. On June 17 a pre-emergence herbicide (LINURON, 2.5 L product/ha) was applied. A post-emergence herbicide (FUSILATE, 2 L product/ha) was applied on July 2. DITHANE (2.2 kg product/ha) and BRAVO (2.4 L product/ha) were applied on July 7, 18 and 29, and on July 22, Aug 6, 12 and 22, respectively for the management of plant pathogens. NOVODOR, (8 L product/ha) for Colorado potato beetle control, was applied to the Foliar and Check treatments on July 22, to all treatments on July 29, and to all treatments at a rate of 16 L product/ha on Aug 6, to control Colorado potato beetles. ADMIRE (200 mL product/ha) was applied to the Foliar treatment on July 22 and Aug 1. The plots were top-killed with REGLONE (2.75 L product/ha) on Sept 5. The number of potato plants and the number of potato plants showing leafroll virus symptoms per sample plot were counted on July 17 and Aug 30. The mean and standard error of the three blocks per treatment are reported here. Aphid flight into the plots was monitored with yellow pan traps. One trap was placed per plot between rows six and seven, 14 m from the east or west end of the plot. Trap position alternated east and west between plots. Traps were emptied twice a week from June 7 to Sept 3, and the number of potato, buckthorn, green peach, and other aphids were counted. Data expressed as proportions were converted with the arcsine transformation before analyses of variance or t-tests. Detransformed means are presented.

RESULTS: There were no significant differences in the percentage of plants showing leafroll virus symptoms between treatments on July 17, at the start of the test, or on Aug 30, at the end of the season. Increase of virus incidence from July 17 to Aug 30 ranged between 2-8% for each treatment but was significant only for the Foliar treatment (Table 1). Treatment means are presented in Tables 1 and 2.

CONCLUSIONS: The small increase in the percentage of plants infected with PLRV in spite of a 30% inoculum may be due to the small number of green peach aphids present in the field between July 17 and Aug 30 (Table 2). This aphid is generally considered the most important aphid vector of PLRV. Together with last year's field trial, these results suggest that in-furrow or foliar applications of ADMIRE will not promote the spread of PLRV but nor will it, like other insecticides, play a significant role in suppressing PLRV spread. Tubers have been harvested and will be tested to confirm field readings.

Table 1. Mean percentage of plants showing PLRV symptoms on July 17 and Aug 30 per treatment.*

		Treatment	
Date	Soil	Foliar	Check
July 17	32.3a	28.6b	31.7a
Aug 30	36.8a	36.9a	33.2a

* Figures are means of three replications. Numbers followed by the same letter in a column are not significantly different according to a t-Test(P•0.05). Numbers in a row were not significantly different.

Table 2. Mean number buckthorn, potato, green peach, and other aphids caught in yellow pan traps per treatment.*

Date	Buckthorn			Potato			Green Peach			Other		
	S	F	C	S	F	C	S	F	C	S	F	C
6/07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.7	1.3
6/11	0.0	0.3	0.0	1.0	0.3	0.7	0.0	0.0	0.0	9.7	15.0	26.0
6/14	0.0	0.3	0.0	0.0	0.3	1.0	0.0	0.0	0.0	5.7	5.0	9.3
6/18	1.7	1.0	1.0	1.7	0.7	1.3	0.0	0.0	0.0	21.0	17.3	27.3
6/21	0.3	0.3	0.7	0.3	0.3	0.3	0.0	0.0	0.0	10.7	12.0	10.3
6/25	0.7	1.0	0.7	0.0	0.3	1.0	0.0	0.0	0.0	7.0	7.7	7.0
6/28	0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	5.3	6.7	9.0
7/02	0.0	0.0	0.0	0.3	1.0	0.7	0.0	0.0	0.0	24.0	17.7	27.0
7/05	0.0	0.3	0.0	0.3	1.0	0.3	0.0	0.0	0.0	34.7	28.3	38.7
7/09	0.3	0.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0	20.0	25.3	25.7
7/12	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	24.0	24.0	16.7
7/16	0.0	0.3	0.0	1.5	0.3	0.3	0.5	0.0	0.0	9.5	15.7	13.0
7/19	0.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	24.3	22.0	21.0
7/23	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	31.3	13.0	10.0
7/26	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.0	15.0	15.0	14.0
7/30	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	9.3	8.3	10.3
8/02	0.3	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.0	14.7	14.7	15.7
8/06	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	15.3	13.0	16.0
8/09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	6.0	7.3
8/13	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.3	0.7	4.0	5.3	4.3
8/16	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.0	3.7	4.3	6.7
8/20	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.3	6.0	4.3	1.7
8/23	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	3.3	2.3	5.3
8/27	0.0	0.3	0.3	0.0	0.0	0.3	0.3	1.7	0.3	11.3	12.0	14.7
8/30	0.0	0.0	0.0	0.3	0.0	0.0	3.0	2.0	0.7	12.3	11.7	13.0
9/03	0.0	0.0	0.3	0.3	0.0	0.0	0.7	0.7	0.3	6.3	11.3	17.7

* Figures are means of three replicates. No statistical analysis done.
S=soil, F=foliar, C=check.

PMR REPORT # 039 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Green peach aphid, *Myzus persicae* (Sulzer); buckthorn aphid, *Aphis nasturtii* Kaltenbach; potato aphid, *Macrosiphum euphorbiae* (Thomas)

NAME AND AGENCY:
BOITEAU G and OSBORN W P L
Agriculture and Agri-Food Canada, Potato Research Centre, P.O. Box 20280,
Fredericton, NB E3B 4Z7
Tel: (506) 452-3260 **Fax**: (506) 452-3316 **Email**: boiteaug@em.agr.ca

TITLE: POTATO COLONIZING APHID CONTROL WITH TWO ADMIRE FORMULATIONS

MATERIALS: ADMIRE 240FS and 70WG (imidacloprid).

METHODS: Plots consisted of four, 7.3 m long rows spaced at 0.9 m. The treatments were completely randomized with four replications. Potatoes were planted May 29, 1996, at a within row spacing of 0.4 m. Pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three D4-45 nozzles per row, at an application volume of 400 L/ha, and a speed of 6 kph. On June 7, a pre-emergence herbicide (LINURON, 2.5 L product/ha) was applied. On July 7, a post-emergence herbicide (FUSILADE, 2 L product/ha) was applied. Each ADMIRE formulation was sprayed onto its respective treatment on July 18, 24, and 29. All plots were treated with ADMIRE 240FS on Aug 7 and 19. DITHANE (2.2 kg product/ha) was applied to all plots to control an unidentified fungal disease on July 7, 18, and 29. BRAVO (2.4 L product/ha) was applied to all plots to control an unidentified fungal disease and late blight on July 22, Aug 6, 12, and 22. The number of each aphid species (sum of nymphs, alate and apterous) was counted on a compound leaf from the top, middle, and bottom of the canopy of each of 10 randomly chosen plants in the middle two rows of each plot on Aug 6. Analyses of variance and LSD tests were carried out on the data.

RESULTS: The treatment means are presented in the Table 1.

CONCLUSIONS: For all three aphid species there were fewer aphids in the two ADMIRE treatments than in the Untreated Check. The abundance of the potato aphid was reduced significantly by the ADMIRE treatments but buckthorn or green peach aphid populations were too low to make treatment differences significant (Table 1). The two ADMIRE formulations are equally effective at controlling populations of the three potato colonizing aphid species.

Table 1. The efficacy of two formulations of ADMIRE agaist aphid species on potato.*

Treatment	Rate	Aphid species		
	(g a.i./ha)	Buckthorn	Potato	Green peach
ADMIRE 249FS	48	0.0	0.0b	0.3
ADMIRE 70WG	48	0.0	0.0b	0.3
Untreated Check	-	0.8	1.3a	2.8
ANOVA P•0.05	-	ns	---	ns

* Figures are means of 4 replications. Means followed by the same letter are not significantly different according to a LSD test (P•0.05).

PMR REPORT # 040 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
BOITEAU G and OSBORN W P L
Agriculture and Agri-Food Canada, Potato Research Centre, P.O. Box 20280, Fredericton, NB E3B 4Z7
Tel: (506) 452-3260 **Fax**: (506) 452-3316 **Email**: boiteaug@em.agr.ca

TITLE: **COLORADO POTATO BEETLE CONTROL TECHNIQUES**

MATERIALS: TD 2344-02 (cypermethrin), MATADOR 120EC and 120C50(lambda-cyhalothrin), ADMIRE 240FS and 70WG (imidacloprid), plastic lined trench (4 mil black mulching), extruded plastic trap.

METHODS: Plots consisted of four, 7.3 m long rows spaced at 0.9 m. The treatments were completely randomized with four replications, except the Untreated Check which had eight replications. Potatoes were planted May 29, 1996, at a within row spacing of 0.4 m. The trenches were installed by June 6 whereas the extruded plastic traps were installed by June 19. The inner edge of either the plastic-lined trench or the extruded plastic traps were 0.9 m from the plots. Pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three D4-45 nozzles per row, at an application volume of 400 L/ha, and a speed of 6 kph. On June 7, a pre-emergence herbicide (LINURON, 2.5 L product/ha) was applied. On July 7, a post-emergence herbicide (FUSILADE, 2 L product/ha) was applied. The Trench and Extruded Trap treatments, which were to be kept within a defoliation rating of 3 (see Table 2) were sprayed with NOVODOR (8 L product/ha) on July 18 and 24. Each chemical insecticide treatment was applied on July 18, 24, and 29 to keep the defoliation rating at 2 or lower. Maintenance sprays of ADMIRE 240FS were made to all treatments on Aug 7 and 19. DITHANE (2.2 kg product/ha) was applied to all plots to control an unidentified fungal disease on July 7, 18, and 29. BRAVO (2.4 L product/ha) was applied to all plots to control an unidentified fungal disease and late blight on July 22, Aug 6, 12, and 22. CPB life stages were counted once a week from June 21 to Aug 19 on 10 randomly chosen plants in the middle two rows of each plot. The defoliation rating of the middle two rows of a plot was taken once a week from June 28 to Sept 3. The plants were top-killed with REGLONE (2.75 L product/ha) on Sept 5 and the middle two rows of each plot were harvested on Sept 17. Analyses of variance and LSD tests were carried out on the data.

RESULTS: The treatment means are presented in the Tables 1 and 2. The population of colonizing overwintered CPB adults was low at the Potato Research Centre in the 1996 season and heavy rainfall during June and July retarded CPB development. The CPB population did start building up in late July when defoliation in the Untreated Check increased (Table 2).

CONCLUSIONS: All treatments were superior to the Untreated Check and equivalent to one another in reducing CPB adults and larvae, but none of the treatments resulted in yield increases that were significantly different from the Untreated Check. The formulation had no impact on the efficacy of ADMIRE or MATADOR. No differences were observed between the two barriers with respect to their effectiveness in controlling the CPB.

Table 1. The mean number of various CPB life stages per 10 plants and the mean total weight yield in tonnes per hectare.*

Treatment	Rate (g a.i/ha)	L2 29/07	L3 01/08	L4 06/08	Adults 19/08	Total Yield
Trench	-	4.0b	2.0b	0.8b	3.0b	30.9
Trap	-	10.8b	0.8b	0.3b	2.0b	31.1
ADMIRE 240FS	48.0	5.0b	0.0b	0.3b	1.8b	30.7
ADMIRE 70WG	48.0	0.8b	0.3b	0.0b	0.8b	29.3
TD 2344-02	39.8	0.5b	0.3b	1.3b	2.0b	29.6
MATADOR 120EC	10.0	2.3b	1.3b	4.3b	6.5b	32.2
MATADOR 120C50	10.0	2.8b	2.0b	11.0b	5.3b	27.8
Untreated Check	-	45.9a	30.5a	56.3a	57.4a	21.0
ANOVA P• 0.05	-	---	---	---	---	ns

* Figures are means of 4 replications, except 8 for the Untreated Check. Means followed by the same letter are not significantly different according to a LSD test (P• 0.05).

Table 2. The mean defoliation ratings of the middle two rows of the treatment plots throughout the sampling period.*

Treatment	Rate (g a.i/ha)	28/06	10/07	29/07	01/08	06/08	19/08
Trench	-	1.1	1.3	1.6b	1.3b	1.3b	1.5b
Trap	-	1.1	1.5	1.5b	1.5b	1.4b	1.5b
ADMIRE 240FS	48.0	1.0	1.5	1.4b	1.3b	1.3b	1.0b
ADMIRE 70WG	48.0	1.3	1.4	1.3b	1.3b	1.3b	1.0b
TD 2344-02	39.8	1.0	1.5	1.5b	1.6b	1.4b	1.6b
MATADOR 120EC	10.0	1.1	1.5	1.6b	1.8b	1.6b	1.5b
MATADOR 120C50	10.0	1.0	1.4	1.8b	1.6b	1.6b	1.5b
Untreated Check	-	1.1	1.4	5.6a	6.5b	6.9a	6.1a
ANOVA P• 0.05	-	ns	ns	---	---	---	---

* Figures are means of 4 replications, except 8 for the Untreated Check. Means followed by the same letter are not significantly different according to a LSD test (P• 0.05). Defoliation ratings: (0) no defoliation; (1) 2-60% of plants with leaflets slightly damaged; (1.5) >60% of plants with leaflets slightly damaged; (2) 2% of plants with •1 compound leaf with •50% defoliation; (3) 2-9% of plants with •1 stem with •50% defoliation; (4) 10-24% of plants with •1 stem with •50% defoliation; (5) 25-49% of plants with •1 stem with •50% defoliation; (6) 50-74% of plants with •1 stem with •50% defoliation; (7) 75-99% of plants with •1 stem with •50% defoliation.

PMR REPORT # 041 SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
MACDONALD I K, STEWART J G and SMITH M E
Agriculture and Agri-Food Canada, Charlottetown Research Centre, P O Box 1210, Charlott
Edward Island C1A 7M8
Tel: (902) 566-6818 **Fax:** (902) 566-6821 **E-Mail:** STEWARTJ@EM.AGR.CA

TITLE: **A COMPARISON OF B.t.t. FORMULATIONS FOR CONTROL OF COLORADO POTATO BEETLE ON POTATO**

MATERIALS: ABG-6444 FC and ABG-6445 FC (*Bacillus thuringiensis* var. *tenebrionis*), ADMIRE 240 F (imidacloprid)

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 9, 1996, in 4-row plots with plants spaced at 0.4 m within rows and 0.9 m between rows. Plots were 7.6 m long and 3.6 m wide, and were separated from each other by two buffer rows of potatoes. They were arranged in a randomized complete block design with eight treatments and four replications. Treatments were applied as foliar sprays, at 303 L/ha and a pressure of approximately 240 kPa, using a CO_2-pressurized precision-plot sprayer. Initial sprays were timed to coincide with first hatch of the CPB egg masses (June 25). Additional sprays were applied one week later on July 2 and, due to wet weather, were reapplied on July 8. Each week from June 24 to August 6, the numbers of early instars (L1-L2), late instars (L3-L4), and adults of the CPB were counted from 10 net sweeps (0.34 m diameter) from the center 2 rows of each plot. Percent defoliation was recorded weekly from July 12 to August 16. Weeds were controlled with an application of metribuzin at 1.1 kg AI/ha on June 8. Plots received recommended applications of chlorothalonil at 1.25 kg AI/ha and copper hydroxide at the same rate for control of late blight. All plots were sprayed with carbofuran at 528 g AI/ha on August 10 to terminate insect activity, and with diquat at 370 g AI/ha on August 27 for top desiccation. Tubers from the center 2 rows of each plot were harvested on September 23, and total and marketable (>38 mm dia.) tuber weights were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln(x + 1) and percent defoliation was transformed to sqrt(arcsine(prop)) before analyses. The detransformed means are presented.

RESULTS: Results are summarized in the Tables below.

CONCLUSIONS: In general, a rate response was observed with ABG-6444 FC and ABG-6445 FC with respect to efficacy against early instars of the CPB (Table 1). The response of the CPB to the two formulations was similar. On July 15, ABG-6444 FC was more effective against late instars of the CPB than was the ABG-6445 FC formulation (Table 2). However, this trend was not evident later in the growing season. ADMIRE was more efficacious than either formulation of Btt (Tables 1 and 2). Less defoliation was observed in plots treated with the bacterial insecticides or with ADMIRE relative to the Check (Table 3). Less defoliation was observed in the plots treated with ADMIRE than in plots treated with Btt. No statistically significant differences in yields were observed for the eight treatments tested. No phytotoxicity was observed at any time during the experiment.

Table 1. A comparison of the efficacy of several rates of two formulations of a B.t.t. insecticide and of ADMIRE against early instars (L1-L2) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1996.

Treatment	Rate (product/ha)	Mean number of CPB early instars (L1-L2)/10 sweeps July 8	July 15	July 22	July 29
Check	---	41.0a*	80.0a	77.3a	40.3ab
ABG-6444 FC	2.3 L	14.0b	27.3cd	32.8b	18.8bc
ABG-6444 FC	4.7 L	4.0c	22.0de	58.0ab	35.3ab
ABG-6444 FC	7.0 L	11.5bc	13.8e	47.8ab	28.3abc
ABG-6445 FC	2.3 L	38.3a	58.5ab	54.3ab	48.8a
ABG-6445 FC	4.7 L	13.0b	43.0bc	41.8b	20.0c
ABG-6445 FC	7.0 L	13.0b	42.5bc	48.0ab	18.0bc
ADMIRE 240 F	0.2 L	0.3d	2.3f	5.0c	5.3d

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. A comparison of the efficacy of several rates of two formulations of a B.t.t. insecticide and of ADMIRE against late instars (L3-L4) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1996.

Treatment	Rate (product/ha)	Mean number of CPB late instars (L3-L4)/10 sweeps July 15	July 22	July 29
Check	---	78.3a*	108.0a	123.3a
ABG-6444 FC	2.3 L	9.0c	55.8bc	70.3a
ABG-6444 FC	4.7 L	4.8c	55.0bc	72.3a
ABG-6444 FC	7.0 L	3.8c	30.3c	71.5a
ABG-6445 FC	2.3 L	40.3ab	91.8ab	92.8a
ABG-6445 FC	4.7 L	18.5b	66.5ab	77.5a
ABG-6445 FC	7.0 L	18.0b	72.3ab	63.5a
ADMIRE 240 F	0.2 L	0.0d	3.0d	15.8b

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 3.Percent defoliation and tuber yields of potato plots protected with B.t.t. or ADMIRE insecticides for the management of the Colorado potato beetle, Harrington, P.E.I., 1996

Treatment	Rate	Percent Defoliation **			Tuber yields	
	(product/ha)	July	--- August ---		Total	Marketable
		19	1	16	(t/ha)	
Check	---	13.5a*	37.0a	65.0a	33.8	31.3
ABG-6444 FC	2.3 L	3.0c	11.6cd	25.8bc	37.7	36.0
ABG-6444 FC	4.7 L	3.0c	19.4bc	24.9c	37.8	35.5
ABG-6444 FC	7.0 L	3.0c	9.8d	21.4c	37.4	35.8
ABG-6445 FC	2.3 L	6.8b	18.8b	34.0b	37.1	35.2
ABG-6445 FC	4.7 L	4.5bc	15.3bc	20.5c	35.5	33.5
ABG-6445 FC	7.0 L	3.4c	9.8d	21.4c	37.6	35.5
ADMIRE 240 F	0.2 L	0.0d	3.0e	3.8d	42.0	39.8
ANOVA $P \leq 0.05$		---	---	---	ns	ns

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

** The data were tranformed to the sqrt(arcsine(prop)) before analysis. Detransformed means are presented.

PMR REPORT # 042 SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
MACDONALD I K, STEWART J G and SMITH M E
Agriculture and Agri-Food Canada, Charlottetown Research Centre, P O Box 1210, Charlottetown, Prince Edward Island, C1A 7M8
Tel: (902) 566-6818 **Fax**: (902) 566-6821 **EMAIL**: STEWARTJ@EM.AGR.CA

TITLE: **MANAGEMENT OF THE COLORADO POTATO BEETLE ON POTATOES**

MATERIALS: TD 2344-02 0.83 EC, SPINOSAD 480 SC (Spinosyn A/D), FURADAN 480 F, Food Grade Soybean Oil.

METHODS: Small, whole seed potatoes were planted at Harrington, Prince Edward Island, on May 9, 1996. Plants were spaced 0.4 m within rows and 0.9 m between rows in 4-row plots. Plots were 7.6 m long and 3.7 m wide, and were separated from each other by two buffer rows of potatoes. Plots were arranged in a randomized complete block design with five treatments, replicated a total of four times except for FURADAN at 0.55 L product/ha and FURADAN at 0.55 L product/ha plus Soybean Oil which had two replications only. Treatments were applied as foliar sprays in 303 L/ha at a pressure of approximately 240 kPa using a CO$_2$-pressurized precision-plot sprayer. The multiplication of spring adults by 1.0, L1-L2 larvae by 0.125, L3-L4 larvae by 0.333, and summer adults by 0.625 converts each growth stage to its CPBE. Treatments were applied whenever a threshold of 2.0 Colorado Potato Beetle Equivalents (CPBE) per net sweep was reached: TD 2344-02 on July 15, SPINOSAD on July 15 and August 14;

the high rate of FURADAN on July 15, 30, and August 14; the low rate of FURADAN on July 15, 30, and August 14; and FURADAN plus Soybean Oil on July 15, 23, 30, and August 14. Each week from June 24 to August 19, the number of early instars (L1-L2), later instars (L3-L4), and adults of the CPB were counted from 10 net sweeps (0.37 m diameter) from the center two rows of each plot. Percent defoliation was recorded weekly from July 12 to August 16. Plots received recommended applications of chlorothalonil at 1.25 kg AI/ha for control of late blight. Plots were sprayed with endosulfan at 720 g AI/ha on August 20 to terminate insect activity in all plots and with diquat at 370 g AI/ha on August 20 for top desiccation. Tubers from the center two rows of each plot were harvested on September 23, and total and marketable (dia. >38 mm dia.) weights were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln(x + 1) and percent defoliation was transformed to sqrt.(arcsine(prop)) before analyses. The detransformed means are presented.

RESULTS: On July 22, the number of early instars was reduced significantly by TD 2344-02, SPINOSAD, and FURADAN at the higher rate (Table 1). The low rate of FURADAN and FURADAN plus the Soybean Oil were not effective (Table 1). TD 2344-02 was the most effective with only a single treatment giving control for the season. Similar trends were noted for late instars (Table 2). TD 2344-02 significantly reduced the number of adults on August 6 and 12 (Table 3). The other treatments were not consistently effective. Defoliation ratings were lowest for TD 2344-02 and SPINOSAD; indicating that either product provided good protection from feeding damage by the CPB (Table 4). Although the yield data were quite variable and no significant differences were observed among treatments, the highest total and marketable yields were obtained from plots treated with a single application of TD 2344-02.

CONCLUSIONS: TD 2344-02 and, to a lesser extent, SPINOSAD provided consistent control of the CPB during the 1996 growing season.

Table 1. A comparison of the efficacy of several insecticides against early instars (L1-L2) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1996.

Treatment	Rate (product/ha)	No. of sprays	Mean number of CPB early instars (L1-L2)/10 sweeps				
			July 8	July 15	July 22	July 29	August 6
Check	---	0	31.8	108.5	50.5a*	39.8a	8.5ab
TD 2344-02	4.0 L	1	43.0	84.0	0.5d	0.5b	0.0c
SPINOSAD	113 g	2	20.5	84.3	6.3c	29.0a	15.8a
FURADAN	1.1 L	3	30.8	67.3	19.5b	31.5a	5.5b
FURADAN	0.55 L	3	75.0	89.5	27.0ab	23.0a	8.0ab
FURADAN + SOYBEAN OIL	0.55 L+0.74 L	4	31.5	87.5	49.0a	31.5a	3.5b
ANOVA P≤0.05			ns	ns	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test (P≤0.05).

Table 2. A comparison of the efficacy of several insecticides against late instars (L3-L4) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1996.

Treatment	Rate (product/ha)	No. of sprays	Mean number of CPB late instars (L3-L4)/10 sweeps					
			July				August	
			8	15	22	29	6	12
Check	---	0	1.0	71.3	90.8a*	89.0a	20.5a	4.3a
TD 2344-02	4.0 L	1	1.5	77.5	0.5d	0.0c	0.0c	1.0b
SPINOSAD	113 g	2	2.0	67.0	13.8c	18.8b	18.3ab	11.3a
FURADAN	1.1 L	3	2.3	61.0	22.8bc	66.0a	7.0b	7.8a
FURADAN	0.55 L	3	0.5	103.0	39.0ab	81.0a	9.0ab	6.0a
FURADAN + SOYBEAN OIL	0.55 L+0.74 L	4	0.5	81.0	69.0a	86.0a	21.5a	5.5a
ANOVA $P \leq 0.05$			ns	ns	---	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 3. A comparison of the efficacy of several insecticides against adults of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1996.

Treatment	Rate	No. of	Mean number of CPB adults/10 sweeps			
	(product/ha)	sprays	July 29	August 6	Aug. 12	Aug. 19
Check	---	0	0.3	18.5a*	39.3b	4.3
TD 2344-02	4.0 L	1	0.0	2.0d	13.0c	7.0
SPINOSAD	113 g	2	0.0	9.3abc	53.3ab	15.0
FURADAN	1.1 L	3	0.3	7.3bc	42.3ab	5.3
FURADAN	0.55 L	3	0.0	13.0ab	92.0a	7.5
FURADAN + SOYBEAN OIL	0.55 L+0.74 L	4	0.0	5.0cd	71.0ab	6.0
ANOVA $P \leq 0.05$			ns	---	---	ns

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 4. Defoliation (%) and tuber yields of potato plots protected with different insecticides for the management of the Colorado potato beetle, Harrington, P.E.I., 1996.

Treatment	Rate (product/ha)	No. of sprays	Defoliation (%)**			-- Tuber yields -	
			July 19	-- August -- 1	16	Total	Marketable (t/ha)
Check	---	0	13.5a	40.0a*	66.8a	30.5	28.1
TD 2344-02	4.0 L	1	6.4b	3.8d	7.3e	36.2	33.9
SPINOSAD	113 g	2	4.1b	7.1cd	22.3d	33.9	31.5
FURADAN	1.1 L	3	4.5b	10.6c	37.3c	34.2	32.2
FURADAN	0.55 L	3	9.0ab	24.0b	59.0b	31.3	28.6
FURADAN + SOYBEAN OIL	0.55 L+0.74 L	4	4.5b	13.5c	56.0b	33.2	31.2
ANOVA $P \leq 0.05$			---	---	---	ns	ns

* Numbers are the means of four replications. Numbers within a column followed by a different letter are statistically different using a protected LSD Means Separation Test ($P \leq 0.05$).

PMR REPORT # 043 **SECTION B:** **INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: **61006535**

CROP: Potatoes, cv. Superior
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say), potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
PITBLADO RE
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: FORMULATION COMPARISONS FOR THE CONTROL OF COLORADO POTATO BEETLE (CPB) USING NOVODOR (ABG-6444FC and ABG-6445FC)

MATERIALS: ABG-6444FC, ABG-6445FC (*Bacillus thuringiensis var. tenebrionis*), ADMIRE 240FS (imidacloprid).

METHODS: Potatoes were planted in single-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 14, 1996. Foliar formulations were applied using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom that delivered 200 L/ha of spray mixture on June 21, July 4, 12, and 20. Assessments were taken by counting the number of CPB larvae and adults per plot (20 plants per plot)on July 5, 23, and Aug. 7 and by foliage damage ratings caused by CPB and leafhopper feeding damage on July 22, and 31. Yields were not taken as a severe hail storm on July 7 severely defoliated the potato foliage, however, plants did regrow. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: The two NOVODOR formulations ABG-6444FC and ABG-6445FC provided excellent CPB control especially at the high rates tested (Table 1). Less damage to foliage was observed in plots treated with the higher rates of NOVODOR regardless of the formulation tested. Neither of the ABG formulated products provided any level of leafhopper control while ADMIRE 240FS provided moderate control. Populations of CPB were relatively low early in the season and only moderate after the July 7 hail storm. Potato plants began to regrow after the storm, however, the leafhopper populations severely restricted the growth on all but the ADMIRE 240FS treated plots. High CPB numbers were observed on the ADMIRE 240FS and the highest rate of ABG-6445FC late in the season due to the amount of foliage remaining on these relatively effective treatments. There appeared to be no significant difference between the two NOVODOR formulations.

Table 1. A comparison of the effectiveness of different rates and formulations of NOVODOR and ADMIRE, 1996.

		Insect Counts/plot								
		July 5			July 23			Aug. 7		
	Rate L	Larvae		Adults	Larvae		Adults	Larvae		Adults
Treatments	prod/ha	Small	Large		Small	Large		Small	Large	
ABG-6444FC	2.3	0.0a*	5.0ab	0.8a	1.3a	1.0b	0.3ab	7.8a	2.5b	0.3a
ABG-6444FC	4.7	0.3a	3.5ab	0.3a	0.3a	0.8b	0.3ab	9.5a	5.0b	1.0a
ABG-6444FC	7.0	0.0a	0.0b	0.0a	0.0a	0.5b	0.0b	6.5a	3.0b	1.5a
ABG-6445FC	2.3	0.0a	0.3b	0.0a	0.0a	0.8b	0.3ab	8.5a	3.5b	1.0a
ABG-6445FC	4.7	0.3a	0.3b	8.8a	0.0a	2.0ab	0.5ab	12.5a	9.0b	2.8a
ABG-6445FC	7.0	0.0a	7.3a	10.8a	1.3a	1.5ab	1.3a	2.5a	37.0a	2.0a
ADMIRE 240FS	0.2	0.0a	0.5b	0.0a	3.8a	2.0ab	0.8ab	3.3a	26.3ab	3.8a
Control		0.0a	1.0b	3.0a	0.0a	8.8a	0.0b	19.3a	2.8b	1.8a

* means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

Table 2. Foliar damage ratings of plots treated with different rates and formulations of NOVODOR and ADMIRE, 1996.

		Foliar Damage Ratings (0-10)*			
	Rate	Colorado Potato Beetles		Leafhoppers	
Treatments	L prod/ha	July 22	July 31	July 22	July 31
ABG-6444FC	2.3	9.0ab**	7.3de	3.0b	2.0b
ABG-6444FC	4.7	9.0ab	9.0abc	3.0b	2.0b
ABG-6444FC	7.0	9.0ab	9.5ab	3.0b	2.0b
ABG-6445FC	2.3	9.0ab	7.8cde	3.0b	2.0b
ABG-6445FC	4.7	9.0ab	9.3ab	3.0b	2.0b
ABG-6445FC	7.0	9.0ab	9.5ab	3.0b	2.0b
ADMIRE 240FS	0.2	9.6a	9.9a	7.8a	6.0a
Control		8.8b	6.5e	3.0b	2.0b

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** Means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 044 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Potatoes, cv. Superior
PEST: Colorado potato beetle, *Leptinotarse decemlineata* (Say), potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
PITBLADO RE
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: EVALUATION OF EXP 60415A FOR THE CONTROL OF THE COLORADO POTATO BEETLE (CPB) IN POTATOES

MATERIALS: EXP 60415A 200SC (fipronil), SEVIN XLR PLUS 480SC (carbaryl), GUTHION 240SC (azinphos-methyl).

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 14, 1996. Foliar applications were made using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture on June 21, July 12, and August 5. Assessments were taken by counting the number of CPB larvae per plot (20 plants per plot) on July 5, 11, Aug. 1, and 7, and foliage damage ratings caused by CPB and leafhopper feeding damage on July 22 and 31. Yields were not taken as plots were defoliated from a hail storm July 7. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05)

RESULTS: Results are presented in the tables below.

CONCLUSIONS: EXP 60415A 200SC effectively controlled CPB but was ineffective in controlling leafhopper damage (Table 2). Early-season populations of CPB were relatively low. However, populations increased dramatically during the first week in August (Table 1). The foliar applications on Aug. 5 significantly controlled these high insect numbers although GUTHION 240SC was the least effective material. The addition of SEVIN XLR PLUS 480SC to EXP 60415A 200SC provided only a relatively small increase in efficacy against the CPB while it was most effective in controlling damage by leafhoppers.

Table 1. A comparison of the effectiveness of different rates of EXP 60415A 200SC in reducing the number of CPB larvae attacking potatoes, 1996.

Treatments	Rate ml product/ha	Larval CPB Counts/plot July 5	July 11	Aug. 1	Aug. 7
EXP 60415A 200SC	62.5	16.8b*	5.3b	39.5a	7.8c
EXP 60415A 200SC	125.0	14.3b	1.0b	40.0a	3.8c
EXP 60415A 200SC	187.5	7.3b	2.5b	18.5b	2.5c
EXP 60415A 200SC	250.0	3.5b	6.8b	17.0b	1.3c
EXP 60415A 200SC +	125.0				
SEVIN XLR PLUS 480SC	1250.0	5.3b	2.0b	41.5a	1.8c
GUTHION 240SC	1500.0	65.0a	3.5b	36.0a	163.8b
Control		21.0b	29.5a	18.0a	305.0a

* means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

Table 2. A comparison of the effectiveness of different rates of EXP 60415A 200SC in reducing the foliar damage caused by CPB and leafhoppers attacking potatoes, 1996.

Treatments	Rate ml product/ha	Foliar Damage Ratings (0-10)* CPB July 31	Leafhoppers July 22	July 31
EXP 60415A 200SC	62.5	7.8bc**	4.0b	3.0b
EXP 60415A 200SC	125.0	8.8ab	4.0b	3.0b
EXP 60415A 200SC	187.5	10.0a	4.0b	3.0b
EXP 60415A 200SC	250.0	9.7a	5.0b	4.0b
EXP 60415A 200SC +	125.0			
SEVIN XLR PLUS 480SC	1250.0	9.3ab	7.5a	6.5a
GUTHION 240SC	1500.0	6.5c	7.0a	6.0a
Control		3.5d	4.0b	3.0b

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 045 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Potatoes, cv. Superior
PEST: Colorado potato beetle, *Leptinotarse decemlineata* (Say), potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
PITBLADO RE
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: EVALUATION OF ADMIRE FOR THE CONTROL OF COLORADO POTATO BEETLE (CPB) IN POTATOES

MATERIALS: ADMIRE 240FS and 70WG (imidacloprid).

METHODS: Potatoes were planted in single-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 14, 1996. The in-furrow applications were applied as a 15 cm band prior to planting. The foliar treatments were applied using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom that delivered 200 L/ha of spray mixture on June 21 and August 2. Assessments were taken by counting the number of CPB larvae and adults per plot (20 plants per plot) on July 5 just prior to a hail storm Aug.1, and 7 just before and after the second foliar application. Foliar damage caused by the CPB and leafhoppers was assessed on July 22 and 31. Yields were not taken as a severe hail storm defoliated the plants on July 7, although plants recovered well throughout the remainder of the season. Results were analyzed using the Duncan's multiple Range Test (P•0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: CPB populations were delayed providing very little pressure early in the season due to the cool spring. The July 5 assessments are reported indicating low CPB pressures just prior to the hail storm on July 7 which defoliated the plants. Although not significant at this early stage, the rate effect of the in-furrow treatment of ADMIRE was becoming apparent. The CPB populations increased significantly during the first week in August. This is considerably later than normal as previously noted. By August 7, the in-furrow treatments were beginning to lose efficacy with the 70WG formulation of ADMIRE being numerically equivalent to the 6.26 ml/100m of row rate of the 240FS formulation in level of CPB insect control. Earlier on July 31 under moderate CPB pressures the 70WG in-furrow application was providing almost equivalent beetle control than the higher 240FS rate. The foliar spray on Aug. 2 provided excellent control of CPB regardless of the formulation. The lower rates of ADMIRE 240FS applied in-furrow did not provide a high level of leafhopper control late in the season. The foliar sprays did not show effective leafhopper control either, however, the application timing was not appropriate for this area. Leafhoppers are most effectively controlled when insecticides are present or applied the first week of July.

Table 1. A comparison of the effectiveness of different rates and formulations of ADMIRE in reducing the number of CPB adult and larval populations.

		Insect Counts/plot			
	Rate	Adults	Larvae	Larvae	Larvae
Treatments	product	July 5	July 5	Aug. 1	Aug. 7
ADMIRE 240 FS	6.26 ml/100m row	8.0a*	3.8a	10.8a	66.0ab
ADMIRE 240 FS	8.33 ml/100m row	2.0a	1.5a	4.5ab	59.8b
ADMIRE 240 FS	12.5 ml/100m row	0.0a	0.0a	0.8ab	46.8bc
ADMIRE 70 WG	2.86 g/100m row	4.3a	3.8a	2.0ab	65.0ab
ADMIRE 70 WG	68.6 g/ha Foliar	9.8a	3.3a	9.8a	2.0c
ADMIRE 240 FS	200 ml/ha Foliar	11.3a	1.5a	0.5ab	1.3c
Control		3.3a	6.8a	9.0a	115.0a

* means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

Table 2. A comparison of the effectiveness of different rates and formulations of ADMIRE in reducing the foliar damage caused by CPB and lefhopper populations.

		Foliar Damage Ratings (0-10)*		
	Rate	CPB	Leafhoppers	
Treatments	product	July 31	July 22	July 31
ADMIRE 240 FS	6.26 ml/100m row	7.0d**	5.3c	5.0c
ADMIRE 240 FS	8.33 ml/100m row	8.0c	7.8b	7.8ab
ADMIRE 240 FS	12.5 ml/100m row	10.0a	9.3a	8.2a
ADMIRE 70 WG	2.86 g/100m row	9.5ab	7.4b	8.3a
ADMIRE 70 WG	68.6 g/ha Foliar	9.3b	4.5cd	2.0c
ADMIRE 240 FS	200 ml/ha Foliar	9.0b	4.3cd	5.8b
Control		4.0e	3.5d	3.3c

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 046 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Potatoes, cv. Chieftan, Yukon Gold, Kennebec
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say), potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
PITBLADO RE
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: **THE ADDITION OF INCITE 92% PBO WITH SYNTHETIC INSECTICIDES FOR INSECT CONTROL IN POTATOES**

MATERIALS: POUNCE 384EC (permethrin), CYMBUSH 250EC (cypermethrin), DECIS 5.0EC (deltamethrin), INCITE 92% PBO (piperonyl butoxide).

METHODS: Potatoes were planted in single-row plots grouped together based on cultivar type, early-, mid-, and late-seasoned cultivars, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 15, 1996. The products were applied using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture on June 21, July 5, 20, and Aug. 2. Assessments were taken by foliage damage ratings caused by CPB and leafhopper feeding damage on July 31 and Aug. 13. Yields were measured on Aug. 19. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: The difference in foliar damage between the lower rates of the pyrethroids and the higher rates plus PBO was evident for the CPB only. The only difference in leafhopper damage was observed for the Chieftans treated with POUNCE at the lower rate on July 31. Damage observed in this treatment was greater than that noted for all other treatments except for the check. CYMBUSH 250EC provided a higher level of CPB control than either POUNCE 384EC or DECIS 5.0EC.

Table 1. A comparison between several synthetic pyrethroid insecticides with and without piperonyl butoxide for the control of CPB and leafhoppers on potatoes.

	Rate		Foliar Damage Rating (0-10)*				
	ml prod		CPB		Leafhoppers		Yield kg/6m
Treatments	/ha	Cultivar	July 31	Aug. 13	July 31	Aug. 31	Harvest area
POUNCE 384EC	275	Chieftan	6.8cd**	3.5fgh	9.8b	7.5abc	14.6a-d
POUNCE 384EC +	550	Chieftan					
INCITE 92% PBO	1160		9.4a	9.1a	10.0a	7.8abc	19.7a
CYMBUSH 250EC	140	Chieftan	7.3b	5.3de	10.0a	7.3abc	15.5abc
CYMBUSH 250EC +	280	Chieftan					
INCITE 92% PBO	1160		9.3a	8.9ab	10.0a	7.5abc	17.4ab
DECIS 5.0EC	150	Chieftan	7.0bc	3.8e-h	10.0a	7.0abc	15.7abc
DECIS 5.0EC +	300	Chieftan					
INCITE 95% PBO	1160		9.0a	8.9ab	10.0a	7.3abc	17.5ab
Control		Chieftan	4.0e	2.5h	7.0e	6.0c	13.7b-e
POUNCE 384EC	275	Yukon Gold	7.3b	4.3efg	10.0a	7.0abc	9.6def
POUNCE 384EC +	550	Yukon Gold					
INCITE 92% PBO	1160		9.0a	7.5bc	10.0a	7.0abc	12.4b-f
CYMBUSH 250EC	140	Yukon Gold	6.5d	5.0def	10.0a	7.0abc	9.0ef
CYMBUSH 250EC +	280	Yukon Gold					
INCITE 92% PBO	1160		9.0a	9.0ab	10.0a	7.0abc	9.4def
DECIS 5.0EC	150	Yukon Gold	7.0bc	3.8e-h	10.0a	7.0abc	7.9f
DECIS 5.0EC +	300	Yukon Gold					
INCITE 92% PBO	1160		9.3a	8.0ab	10.0a	7.0abc	8.6ef
Control		Yukon Gold	4.0e	2.5h	9.0c	6.0c	9.0ef
OUNCE 384EC	275	Kennebec	7.0bc	5.0def	10.0a	8.3a	7.7f
UNCE 384EC +	550	Kennebec					
INCITE 95% PBO	1160		9.3a	8.4ab	10.0a	8.3a	11.9c-f
CYMBUSH 250EC	140	Kennebec	7.3b	6.3cd	10.0a	8.3a	8.7ef
CYMBUSH 250EC +	280	Kennebec					
INCITE 95% PBO	1160		9.4a	9.1a	10.0a	8.5a	9.6def
DECIS 5.0EC	150	Kennebec	7.0bc	6.0d	10.0a	8.0ab	6.8f
DECIS 5.0EC +	300	Kennebec					
INCITE 92% PBO	1160		9.3a	9.1a	10.0a	8.5a	10.5c-f
Control		Kennebec	4.0e	3.3gh	8.0d	6.3bc	6.5f

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 047 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Potatoes, cv. Superior
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say), potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
PITBLADO RE
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: BRIDGING LAMBDA-CYHALOTHRIN TO GFU 383C FORMULATIONS FOR CONTROL OF COLORADO POTATO BEETLE (CPB) IN POTATOES

MATERIALS: MATADOR 120EC and 120CSO (lambda-cyhalothrin).

METHODS: Potatoes were planted in single-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 14, 1996. The foliar formulations were applied using a specialized small plot research CO_2 sprayer with a two-nozzle hand-held boom that delivered 200L/ha of spray mixture on June 21, July 5, 20, and Aug. 2. Assessments were taken by counting the number of CPB larvae per plot (20 plants per plot) on June 24, 28, July 5, 23, 26, Aug. 1, and Aug. 7. Foliar damage ratings caused by the CPB and leafhopper feeding damage were recorded on July 22 and 31. Yields were not taken as a severe hail storm defoliated the plants on July 7, with plant growth recovering throughout the summer. Results were analyzed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: Both formulations of lambda-cyhalothrin, MATADOR 120EC and MATADOR 120CSO provided excellent and equal control of both the CPB and leafhoppers (Table 1). Beetle populations were increasing in numbers by July 5, just prior to the severe hail storm and then later in the season by August 7. Leafhopper populations were extremely high in these plots causing considerable foliar leafhopper burn.

Table 1. A comparison between the two formulations of MATADOR in reducing the number of CPB larvae attacking potatoes.

	Rate ml	CPB Larval Counts/plot						
Treatments	prod/ha	June 24	June 28	July 5	July 23	July 26	Aug.1	Aug. 7
MATADOR 120EC	83.5	0.0b*	6.3b	34.6ab	0.8b	0.8b	11.0a	63.3a
MATADOR 120CSO	83.5	0.8b	4.0b	23.0b	0.5b	1.0b	13.5a	56.0a
Control		7.3a	16.5a	46.1a	20.8a	25.3b	16.5a	185.0b

* means followed by the same letter do not significantly differ (P• 0.05, Duncan's Multiple Range Test).

Table 2. A comparison between the two formulations of MATADOR in reducing the foliar damage caused by CPB and leafhoppers.

		Foliar Damage Ratings (0-10)*		
	Rate	CPB	Leafhoppers	
Treatments	ml prod/ha	July 31	July 22	July 31
MATADOR 120EC	83.5	8.8a**	9.8a	9.0a
MATADOR 120CSO	83.5	8.5a	10.0a	9.0a
Control		4.3b	5.0b	4.0b

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control

** means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 048 **SECTION B: VEGETABLES AND SPECIAL CROPS**
ICAR/IRAC: 86100104

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:

SEARS M K and MCGRAW R R
Department of Environmental Biology, University of Guelph, Guelph, Ontario,
N1G 2W1 **Tel:** (519) 824-4120, ext. 3567 **Fax:** (519) 837-0442
Email: msears@evbhort.uoguelph.ca

TITLE: EFFECTS OF VARIOUS RATES AND COMBINATIONS OF INSECTICIDES ON THE CONTROL OF COLORADO POTATO BEETLE (CPB), 1996

MATERIALS: SPINOSAD NAF 85 (*Saccharopolyspora spinosa* 480 EC), SPINOSAD NAF 295 (S. *spinosa* 240 EC), GFU383 120 EC, WF1621 120 EC (fenpropathrin), ADMIRE 240 FS (imidacloprid), ABG 6444 (*Bacillus thuringiensis tenebrionis* 3% w/w), ABG 6445 (B. *thuringiensis tenebrionis* 3% w/w), FIPRONIL 80 WG.

METHODS: Potatoes were planted on May 8, in four-row plots, 15 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 750 L/ha at 450 kPa. Two hundred CPB egg masses were flagged on June 21 and checked daily to determine hatch. By June 24, 38% of the egg masses were hatched. The initial spray of all treatments was applied on June 25. A second spray against the first generation of CPB was applied to all treatments July 4 except for the WF 1621 treatments. One WF 1621 treatment was applied on a seven-day interval, June 25 and July 2, the other on a fourteen-day interval, June 25 and July 9.

Populations of CPB were monitored three days after the initial spray and weekly thereafter. Counts were taken by examining five plants in each plot and the numbers of larvae and adults were recorded. The percent defoliation caused by adults and larvae was estimated. Tubers were harvested August 23.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: After two sprays the low rate of Spinosad NAF 85, the mid-rate of Spinosad NAF 295 and the GFU 383C formulation of fenpropathrin provided control of large larva for two weeks. The high rate of ABG 6444 and ABG 6445 also gave two weeks of control of CPB large larvae. The lower rates of this product were not effective in larval control. All other treatments significantly reduced the number of large larvae for three weeks.

The fourteen day schedule of WF 1621 was just as effective as the seven day schedule.

All treatments significantly increased yields when compared to the check except for the two lower rates of ABG 6445, the mid-rate of ABG 6444, the low rate of Spinosad NAF 295, and the high rate of Spinosad NAF 85.

Table 1. A comparison of the effects of five insecticides on the CPB and yield of potatoes, Guelph, Ontario, 1996.

Insecticide	Rate (gai/ha)	Large larvae*			Percent defoliation			Yield (t/ha)
		July 8	July 17	July 24	July 8	July 17	July 24	
Spinosad NAF 85	25.0	0.0e	0.1c	2.6abc	1.7c	3.0efg	3.9bcdef	17.2abcde
Spinosad NAF 85	37.5	0.0e	0.0e	0.9c	1.1c	1.3g	2.2def	15.3bcde
Spinosad NAF 85	50.0	0.0e	0.1e	0.3c	1.0c	3.2efg	1.0def	17.7abcde
Spinosad NAF 85	100.0	0.0e	0.1e	0.1c	1.5c	2.3efg	1.4def	14.7bcdef
Spinosad NAF 295	25.0	0.02e	0.1e	0.9c	1.5c	3.3efg	5.6bcdef	13.3def
Spinosad NAF 295	37.5	0.0e	0.0e	0.8c	2.4c	2.2efg	4.9bcdef	14.6bcde
Spinosad NAF 295	50.0	0.0e	0.0e	2.3abc	2.2c	3.4efg	2.7cdef	16.5abcde
Spinosad NAF 295	100.0	0.0e	0.0e	0.0c	1.1c	1.8fg	1.0def	17.5abcde
GFU 383C	10.0	0.2e	0.3e	3.8abc	1.8C	4.0efg	5.0bcdef	17.8abcde
WF 1621 (7-day)	10.0	0.0e	0.0e	1.6bc	1.9c	4.9defg	4.5bcdef	15.0bcde
WF 1621 14-day)	10.0	1.4c	1.7de	2.0bc	3.7bc	4.0efg	4.8bcdef	16.2abcde
Admire (in-furrow)	10ml/100M	0.0c	0.0e	0.0c	0.5c	0.9g	0.2f	22.9ab
Admire (foliar)	50.0	0.0c	0.0e	0.1c	0.7c	3.4efg	0.7ef	24.5a
ABG 6444	2.3 L/ha	1.8c	2.1de	1.0c	3.1bc	8.2cdefg	5.0bcdef	16.6abcde
ABG 6444	4.7 L/ha	2.8bc	4.1bcde	2.0bc	6.1bc	12.0cdefg	8.5bcdef	12.6ef
ABG 6444	7.0 L/ha	0.2c	0.5e	1.9bc	3.0bc	3.3efg	2.9cdef	15.9abcde
ABG 6445	2.3 L/ha	8.0ab	9.6ab	3.4abc	6.2bc	17.0bc	13.1b	12.3ef
ABG 6445	4.7 L/ha	2.1c	8.9abc	4.2abc	4.4bc	12.6bcde	13.1b	13.9cdef
ABG 6445	7.0 L/ha	2.9bc	4.1bcde	3.3abc	2.1c	14.7bcd	9.7bcde	15.6bcde
Fipronil	12.5	0.1c	0.2e	0.0c	1.4c	7.8cdefg	1.3def	15.8abcde
Fipronil	25.0	0.0c	0.0e	0.0c	1.4c	2.3efg	1.0def	17.5abcde
Fipronil	37.5	0.0c	0.0e	0.0c	2.5c	2.3efg	1.9def	17.4abcde

Fipronil	50.0	0.0c	0.0e	0.0c	1.3c	2.3efg	1.3def	22.2abc
Unsprayed check**		9.2a	10.7a	6.7a	23.4a	36.0a	34.4a	6.2f

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* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

** 1st generation.

PMR REPORT # 049 SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say); potato flea beetle (PFB), *Epitrix cucumeris* (Harr.); tarnished plant bug (TPB), Lygus lineolaris P. de Beauvois; potato aphid (PA), *Macrosiphum euphorbiae* (Thos.)

NAME AND AGENCY:
SMITH M E, MACDONALD I K and STEWART J G
Agriculture and Agri-Food Canada, Research Centre, P O Box 1210,
Charlottetown, PE C1A 7M8
Tel: (902) 566-6800 **Fax:** (902) 566-6821 **E-Mail:** STEWARTJ@EM.AGR.CA

TITLE: **EVALUATION OF FIPRONIL FOR EFFICACY AND RESIDUAL ACTIVITY AGAINST POTATO INSECT PESTS**

MATERIALS: FIPRONIL (EXP60145A), ADMIRE 240 FS (imidacloprid), FURADAN 480 F (carbofuran)

METHODS: Small, whole seed potatoes were planted in Harrington, P.E.I., on May 9, 1996. Plants were established in four-row plots, spaced at about 0.4 m within rows and about 0.9 m between rows. The plots, measuring 7.6 m in length and 3.6 m in width, were separated from each other by two buffer rows of potatoes. Plots were arranged in a randomized complete block design, with six treatments each replicated four times. Starting on June 24, counts of CPB early instars, late instars, and adults, as well as potato flea beetles, tarnished plant bugs, and potato aphids, were done weekly from 10 net sweeps per plot. Initial treatments of FIPRONIL and ADMIRE were applied as foliar sprays on July 15, when a threshold of 2.0 CPBE per sweep was reached on all plots, using a CO_2-pressurized precision plot sprayer at 240 kPa and 303 L H_2O/ha. The multiplication of spring adults by 1.0, L1/L2 larvae by 0.125, L3/L4 larvae by 0.333, and summer adults by 0.625 converts each growth stage to its CPBE. The threshold was exceeded again in the ADMIRE treatment on August 12, and, as per the protocol, a foliar application of FURADAN was made to those plots. After the July 15 spray, post-spray counts and defoliation ratings were done at 1 (July 16), 3 (July 18), 7 (July 22), 10 (July 25), and 14 (July 29)days post-spray, and on a weekly basis thereafter until August 19. To prevent interplot movement of CPB, applications of imidacloprid at 48 g AI/ha were made to the buffer rows on July 23 and August 12. All plots were treated with permethrin at the rate of 90 g AI/ha on August 21 to eliminate CPB summer adults, and diquat was applied at the rate of 370 g AI/ha to the entire experiment on August 27 for top desiccation. After planting, plots received a pre-emergence application of metribuzin at 1.1 kg AI/ha for weed control. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha and copper hydroxide at 1.25 kg AI/ha for late blight control. Tubers from the center two rows of each plot were harvested on September 23, and total and marketable (dia.>38 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt(arcsine(prop)) before analysis. Detransformed means are presented.

RESULTS: The single spray of all four rates of FIPRONIL resulted in season-long control of the CPB, while counts in plots receiving the single ADMIRE application remained below the 2.0 CPBE threshold for almost one month (Table 1). Although from week to week the efficacy of the different FIPRONIL treatments varied, overall there were no significant differences between the levels of control achieved with the four rates of FIPRONIL or the single rate of ADMIRE. For all counting dates, all treatments significantly reduced the numbers of CPB relative to the Check plots. Neither FIPRONIL at any rate nor ADMIRE were effective at reducing the population of PFB, but the application of FURADAN to the ADMIRE plots on August 12 did cause a significant reduction (data not shown). The ADMIRE treatment tended to reduce numbers of PA compared with the Check, and on July 25 and July 29 the differences were significant (Table 2). Although the results were not clear-cut, the trend was for PA counts in all FIPRONIL plots to be higher than those in the Check plots (Table 2). The TPB populations remained very low throughout the season, and did not appear to be consistantly affected by any treatments. All products protected potato foliage from feeding damage by the CPB (Table 3). Although the ADMIRE treatment gave higher total tuber yields than did any FIPRONIL treatment, and all treated plots yielded better than did the Check, differences were not significant. There were significant differences in marketable tuber yields between all treatments and the Check, but none among the different treatments.

CONCLUSIONS: Even at the lowest rate, one application of FIPRONIL provided excellent season-long control of all life-stages of the CPB. Although ADMIRE initially provided good control, CPB populations required further treatment by mid-summer. Neither FIPRONIL nor ADMIRE reduced PFB numbers consistently. Only ADMIRE reduced PA populations significantly compared to the Check. Both products were equally efficacious in reducing plant defoliation and in protecting marketable tuber yields.

Table 1. Effectiveness of FIPRONIL and ADMIRE for the management of the Colorado potato beetle.

Treatment	Rate (g AI/ha)	CPBE/sweep						
		July					August	
		16	18	22	25	29	6	12
Check	-	2.5a*	3.1a	3.2a	5.1a	3.4a	2.2a	4.6a
FIPRONIL 200SC	12.5	1.1b	0.2b	0.2b	0.3bc	0.3bc	0.6bc	1.5bc
FIPRONIL 200SC	25.0	0.7bc	0.1bc	0.0b	0.0c	0.1c	0.7bc	1.6b
FIPRONIL 200SC	37.5	0.7bc	0.0bc	0.0b	0.1c	0.1c	0.1d	0.7c
FIPRONIL 200SC	50.0	0.2d	0.0c	0.1b	0.0c	0.0c	0.2cd	1.2bc
ADMIRE 240 F	48.0	0.4cd	0.0bc	0.1b	0.6b	0.5b	0.9b	2.2b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P \leq 0.05$).

Table 2. Effectiveness of FIPRONIL and ADMIRE for potato aphid management.

Treatment	Rate (g AI/ha)	PA/sweep						
		July					August	
		16	18	22	25	29	6	12
Check	-	3.5	3.8b*	17.3	38.0b	78.0b	10.5bc	10.8
FIPRONIL 200SC	12.5	5.5	7.5ab	18.8	59.5ab	99.0ab	12.3bc	8.0
FIPRONIL 200SC	25.0	4.5	7.0ab	19.0	45.3ab	107.3a	23.5ab	6.3
FIPRONIL 200SC	37.5	4.3	7.0ab	15.8	41.8ab	116.0a	47.3a	8.5
FIPRONIL 200SC	50.0	5.0	13.5a	21.0	64.5a	112.0a	23.5b	7.0
ADMIRE 240 F	48.0	1.8	3.8b	8.5	10.0c	10.3c	6.5c	9.3
ANOVA ($P \leq 0.05$)		ns	-	ns	-	-	-	ns

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P \leq 0.05$).

Table 3. Effectiveness of FIPRONIL and ADMIRE in reducing plant defoliation and increasing marketable tuber yields through control of the CPB.

Treatment	Rate (g AI/ha)	Percent Defoliation**					Marketable tuber yield (t/ha)
		July		August			
		18	25	1	6	12	
Check	-	12.5a*	18.8a	35.5a	28.8a	57.3a	33.4b
FIPRONIL 200SC	12.5	5.8b	5.3b	4.5b	9.0b	11.6b	40.4a
FIPRONIL 200SC	25.0	5.8b	4.5b	3.0c	5.0d	5.3c	40.8a
FIPRONIL 200SC	37.5	5.0b	4.5b	3.0c	5.3d	5.3c	40.8a
FIPRONIL 200SC	50.0	5.0b	4.5b	3.0c	5.3d	3.8c	41.4a
ADMIRE 240 F	48.0	5.0b	3.4c	3.0c	7.3c	10.6b	43.8a

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P \leq 0.05$).

** Means transformed to sqrt(arcsine(prop)) before analysis. Detransformed means presented.

PMR REPORT # 050 SECTION B:
INSECTS OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
STEWART J G, SMITH M E and MACDONALD I K
Agriculture and Agri-Food Canada, Research Centre, P O Box 1210,
Charlottetown, PE C1A 7M8
Tel: (902) 566-6800 **Fax:** (902) 566-6821 **E-Mail:** STEWARTJ@EM.AGR.CA

TITLE: **TEST OF AN IN-GROUND TRENCH OR AN ABOVE-GROUND TRAP VS CONVENTIONAL TREATMENT FOR COLORADO POTATO BEETLE CONTROL ON POTATOES**

MATERIALS: NOVODOR 3% (*Bacillus thuringiensis* var.*tenebrionis)*, ADMIRE 240 F (imidacloprid)

METHODS: Small, whole potatoes were planted at Harrington, P.E.I. on May 9, 1996. Plants were established in four-row plots with a spacing of about 0.4 m within rows and about 0.9 m between rows. The plots, measuring 7.6 m in length and 3.6 m in width, were arranged in a randomized complete block design with three contiguous replications and four treatments. The in-ground plastic-lined trenches (Trench) or surface-mounted polyethylene traps (Trap) were installed on one side of the potato rows, while two buffer rows of NewLeaf (B.t.t.-transgenic) Russet potatoes were planted on the other side, between the plots and the rest of the field, to inhibit movement of non-experimental insects into the plots. Plots and barriers were separated from each other by 23 cm high vertical pieces of steel flashing set up at right angles to the rows. On June 17, fifty colour-coded CPB adults were released in front of each plot, either on the ground in front of the barriers or in the same position in the plots lacking barriers. For the next four days, all plants in each plot were examined to determine the number of marked insects which had successfully entered the plots. Subsequently, whole-plant counts of CPB spring adults, early (L1/L2) and late (L3/L4) larvae, and summer adults were carried out on ten plants per plot from June 24 until August 21. Weekly defoliation ratings were done from July 19 until August 16. When a threshold of 2.0 Colorado Potato Beetle Equivalents (CPBE) per plant was exceeded on July 8, a foliar spray of NOVODOR at 8.0 L prod./ha was applied to the foliar-spray treatment using a tractor-mounted precision plot sprayer at 240 kPa and 303 L H_2O/ha. The multiplication of spring adults by 1.0, L1/L2 larvae by 0.125, L3/L4 larvae by 0.333, and summer adults by 0.625 converts each growth stage to its CPBE. ADMIRE at 48 g AI/ha was applied to the foliar spray treatment when the threshold was exceeded again on July 22 and August 12. Diquat was applied at the rate of 370 g AI/ha to the entire experiment on August 22 for top desiccation. Weed control was achieved through the application of metribuzin at 1.1 kg AI/ha on June 8. Throughout the summer, plots received recommended applications of chlorothalonil at the rate of 1.25 kg AI/ha and copper hydroxide at 1.25 kg AI/ha for late blight control. Tubers from the center two rows of each plot were harvested on September 24, and total and marketable (dia.>38 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln(x+1) before analysis. Percent defoliation was transformed to sqrt(arcsine(prop)) before analysis. Detransformed means are presented.

RESULTS: Results are summarized in the tables below.

CONCLUSIONS: Fewer marked adults were recovered on potato plants one and four days after release in plots protected by a trench or a trap than on plants of the other two treatments tested (Table 1). While fewer adults, egg masses, and larvae were observed on plants in plots that had a barrier to restrict the movement of the CPB, this trend was not always significant (Table 2). A trench or trap barrier effectively reduced the level of defoliation relative to the Check. However, an application of NOVODOR followed by two applications of ADMIRE provided better protection than either barrier. Although the marketable and total tuber yields from the Foliar Spray treatment were greater than the yields from the other three treatments, the differences were not statistically different. Weights averaged over the four treatments were 33.1 t/ha for marketable yield and 35.8 t/ha for total yield.

Table 1. Recovery of marked CPB adults in a trench/trap or on plants one and four days after release.

Treatment	Average no. of CPB adults found*			
	Day 1		Day 4	
	Trench	On Plants	Trench	On Plants
Check	N/A	20.0a	N/A	20.0a
Plastic-lined dug trench	2.3a	2.3b	1.3a	3.7c
Plastic trap	7.0a	3.7b	7.7a	7.7b
Foliar spray	N/A	16.0a	N/A	24.3a

* Numbers in a column followed by a different letter are significantly different using a protected LSD Means Separation Test ($P \leq 0.05$).

Table 2. A comparison of the effectiveness of different control tactics for the Colorado potato beetle on potatoes, P.E.I., 1996.

Treatment	Mean No./10 Plants - July 3			L3/L4	% Defoliation	
	Adults	Egg Masses	L1/L2	July 15	July 25	Aug. 16
Check	2.3*	21.3	53.3	71.0a	13.5a	37.0a
Trench	1.0	7.3	13.3	23.7b	4.5b	19.3b
Trap	0.7	9.7	8.3	17.0b	5.0b	20.5b
Foliar sprays	3.3	15.7	41.0	24.3b	5.5b	17.0c
ANOVA ($P \leq 0.05$)	ns	ns	ns	---	---	---

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P \leq 0.05$).

REPORT # 051 **SECTION B: INSECTS OF VEGETABLE AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
TOLMAN J H, ARMSTRONG S D, BELL G M and WILSON M
Agriculture and Agri-Food Canada, Pest Management Research Centre, 1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 ext. 232 **Fax:** (519) 457-3997 **E-mail:** tolmanj@em.agr.ca

TITLE: RELATIVE PERSISTENCE OF CONTROL AGENTS APPLIED TO POTATO FOLIAGE FOR CONTROL OF COLORADO POTATO BEETLE

MATERIALS: ADMIRE 240 F (imidacloprid), SPINOSAD 480 SC (spinosyn A/D), NOVODOR (*Bacillus thuringiensis* var. *tenebrionis*), RIPCORD 400 EC (cypermethrin), STALKER 240 SC (chlorfenapyr) KRYOCIDE 96WP (cryolite), GOVERNOR 75WP (cyromazine), REGENT 200 F (fipronil).

METHODS: Chitted seed potatoes were planted in London on May 7 in single-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated three times in a randomized complete block design. On June 23 when plants were in full flower, 55 fully expanded leaves were tagged in each plot. On 24 June all treatments (Table 1) were applied at 210 kPa in 900 L/ha using a single-nozzled (D-4-25 hollow cone) Oxford precision sprayer. Residual effectiveness of foliar deposits against both adult and larval insecticide-susceptible CPB was measured by bioassay. As soon as spray deposits had dried on the foliage, a total of 6 tagged leaves were harvested from each plot of each tmt. and returned to the laboratory for bioassay. Leaves were thereafter collected at regular intervals for further bioassay (Table 2-3). On each collection date a total of 9 adult-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing 1 leaf and 5 CPB adults, and 6 larval-bioassays (2 bioassays/plot x 3 plots/tmt.), each containing 2 x 3.6 cm leaf discs and 10 first instar CPB larvae, was established for each treatment. Bioassays were held at 25•C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's correction and then subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; Least Squares Differences (LSD) were calculated and used to estimate significance of differences among treatment means. Adult-damage reduction was determined by subtracting individual bioassay damage ratings from the average CONTROL damage rating and calculating % reduction. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR portable leaf area meter; larval damage reductions were calculated by subtracting leaf-areas consumed in individual treatment bioassays from the mean leaf area consumed in CONTROL bioassays and calculating % reduction. T70's, the length of time, in days, that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70%, were estimated visually by drawing a line vertically from the intersection of the arbitrarily chosen 70% response level with a plot of CPB Response (corrected % mortality or % damage reduction) against Days after Treatment.

RESULTS: See Tables 2-4 below. No rain fell during the 24 hrs after application; a total of 10.4 mm of rainfall subsequently accumulated within 4 days of treatment. Temperature during the 4 days following application averaged 18.4•C. No phytotoxicity was noted following treatment.

CONCLUSIONS: At the arbitrary threshold of 70% CPB response, under the weather conditions of this experiment, we noted large differences in the relative persistence of tested control agents on potato foliage. For all measured responses, REGENT, with a T70 of at least 10 days, proved most persistent (Table 4). REGENT, however, was the only tested control agent for which the mortality T70 for first instars was essentially equal to the T70 for adult CPB; larva-T70/adult-T70 for other agents ranged from 1.4 (STALKER) to 42.0 (RIPCORD). As measured by mortality of first instar CPB larvae, the observed order of persistence was REGENT > RIPCORD > ADMIRE > KRYOCIDE > SPINOSAD > STALKER > GOVERNOR = NOVODOR. As measured by reduction of leaf feeding by first instar CPB larvae, the observed order of persistence was REGENT > RIPCORD > KRYOCIDE > ADMIRE > SPINOSAD > NOVODOR; neither STALKER nor GOVERNOR exceeded the 70% threshold for damage reduction at any time. Both STALKER and GOVERNOR thus appear to be slow acting toxins; while larvae feeding on treated foliage ultimately die, they continue to feed and damage potato foliage for a considerable period after initial exposure. As measured by mortality of adult CPB, the observed order of persistence was REGENT > ADMIRE > STALKER > SPINOSAD > RIPCORD. As measured by reduction of leaf feeding by adult CPB, the observed order of persistence was REGENT > RIPCORD > ADMIRE > SPINOSAD > STALKER. These data again emphasize the importance of field scouting since growers with access to tested control agents would have many more options for control of early instar CPB than adult CPB.

Table 1. Control agents applied to potato foliage.

No.	Treatment	Rate (amt/ha)	No.	Treatment	Rate (amt/ha)
1	ADMIRE 240 F	0.2 L	6	KRYOCIDE 75 WP	13.0 kg
2	SPINOSAD 480 SC	0.1 L	7	GOVERNOR 75 WP	375.0 g
3	NOVODOR	7.0 L	8	REGENT 200 F	125.0 ml
4	RIPCORD 400 EC	87.5 ml	9	CONTROL	---
5	STALKER 240 SC	0.4 L			

Table 2. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle larvae.

No.	CPB Response on Indicated Day After Treatment									
	Day 0		Day 1		Day 2		Day 3		Day 4	
	D.R.*	Mort.**	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.
1	76.0	100.0a***	84.5	100.0a	88.1	100.0a	98.2	100.0a	83.8	79.7bc
2	81.5	100.0a	84.2	100.0a	88.0	98.3a	88.4	100.0a	83.8	88.4ab
3	82.6	100.0a	83.5	89.5b	90.8	95.0ab	36.9	30.5b	0.0	24.3e
4	88.4	98.3a	75.2	100.0a	97.0	100.0a	99.5	100.0a	88.4	100.0a
5	24.1	78.3b	31.5	98.3ab	63.0	95.0ab	63.2	84.9a	25.4	66.1cd
6	76.4	100.0a	85.1	100.0a	96.4	98.3a	100.0	100.0a	82.0	100.0a
7	63.5	76.7b	59.7	89.5b	69.0	88.3b	52.3	49.1b	47.9	47.5d
8	80.4	100.0a	71.9	100.0a	90.5	100.0a	88.1	94.3a	89.3	100.0a
9	3.04*****		3.38		3.02		1.91		1.85	

No.	CPB Response on Indicated Day After Treatment							
	Day 8		Day 10		Day 14		Day 20	
	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.
1	67.3	40.7b	46.2	28.8b	47.0	8.5b	45.1	14.5a
2	34.9	10.7c	48.6	9.0c	46.7	10.4b	11.0	10.6a
3	38.2	22.9bc	--	--****	--	--	--	--
4	88.4	98.3a	90.1	91.5a	83.3	58.5a	25.8	12.7a
5	30.8	37.9bc	--	--	--	--	--	--
6	61.5	100.0a	90.1	100.0a	81.0	71.7a	21.0	17.6a
7	63.5	50.9b	50.0	20.3bc	58.1	12.3b	18.7	10.9a
8	94.0	100.0a	91.5	100.0a	94.0	66.0a	41.8	38.1a
9	4.22		4.14		5.14		3.31	

* % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 9).

** Corrected % Mortality.

*** Means within a column followed by the same letter are not significantly different (P• 0.05) as determined using a LSD means separation test.

**** Bioassay not undertaken due to lack of efficacy in earlier test.

***** Actual area (cm^2) of leaf discs consumed during 72 hr feeding period.

Table 3. Relative persistence of control agents applied to potato foliage for control of Colorado potato beetle adults.

No.	Day 0		Day 1		Day 2		Day 3		Day 4	
	D.R.*	Mort.**	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.
1	97.5	75.6c***	96.3	88.9a	93.3	84.4ab	95.3	84.1ab	82.5	66.7b
2	73.2	88.9abc	31.6	60.0b	7.5	22.2c	2.9	21.5d	5.9	2.2c
4	89.6	82.2bc	89.5	40.0b	87.0	68.9b	76.2	45.5c	84.8	80.0ab
5	2.6	95.6ab	16.8	88.9a	15.1	86.4ab	3.6	61.6bc	9.3	62.2b
8	73.5	100.0a	72.7	100.0a	84.2	100.0a	74.7	100.0a	84.2	100.0a
9	9.5*****		9.6		9.3		8.3		9.3	

No.	Day 8		Day 10		Day 14	
	D.R.	Mort.	D.R.	Mort.	D.R.	Mort.
1	51.1	25.9cd	54.6	13.7b	23.5	4.4b
2	15.2	2.2d	--	--****	--	--
4	77.7	62.2b	48.5	23.0b	28.4	8.9b
5	12.7	48.9bc	--	--	--	--
8	73.3	95.6a	70.3	100.0a	28.7	64.4a
9	9.2		8.8		9.0	

* % Damage Reduction relative to feeding damage in leaves from CONTROL plots (Tmt. 9).

** Corrected % Mortality.

*** Means within a column followed by the same letter are not significantly different (P•0.05) as determined using a LSD means separation test.

**** Bioassay not undertaken due to lack of efficacy in earlier test.

***** Actual 72-hour Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

Table 4. Relative foliar T70's for control agents applied to potato for control of Colorado potato beetle.

No	Treatment	Rate (amt/ha)	T70* (days) for Indicated CPB Response			
			Damage Reduction		Mortality	
			Adult	Larva	Adult	Larva
1	ADMIRE 240 F	0.2 L	5.6	5.1	3.9	6.8
2	SPINOSAD 480 SC	0.1 L	0.1	4.7	0.6	4.9
3	NOVODOR	7.0 L	---**	2.4	---	2.4
4	RIPCORD 400 EC	87.5 ml	8.5	15.7	0.3	12.6
5	STALKER 240 SC	0.4 L	0.0	0.0	2.7	3.8
6	KRYOCIDE 75 WP	13.0 kg	---	14.2	---	5.4
7	GOVERNOR 75 WP	375.0 g	---	0.0	---	2.5
8	REGENT 200 F	125.0 ml	10.0	17.5	13.3	13.4

* Time period (days) that feeding damage in treatment plots was at least 70% less than feeding damage in untreated CONTROL plots and/or that corrected mortality of CPB feeding on treated leaves exceeded 70%.

** Trial not done due to demonstrated lack of effect on noted life stage.

PMR REPORT # 052 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Rutabaga, cv. Laurentian
PEST: Imported cabbagwworm, *Artogeia rapae* (L), flea beetle, *Phyllotreta pusilla*(L)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: **FOLIAR INSECT CONTROL IN RUTABAGAS**

MATERIALS: ADMIRE 240FS (imidocloprid), VYDATE L (oxamyl), RH-5992 240F (tebufenozide), METASYSTOX-R 240SC (oxydemeton-methyl), CYGON 480E (dimethoate), THIODAN 4EC (endosulfan), LORSBAN 4E (chlorpyrifos), SEVIN XLR PLUS (carbaryl), CYMBUSH 250EC (cypermethrin), DIPEL 2XDF *(Bacillus thuringiensis* var. *kurstaki*).

METHODS: Rutabagas were seeded in three-row plots, 8 m in length with rows spaced 0.75 m apart, replicated four times in a randomized complete block design. Plots were established at the Huron Research Station near Centralia on June 14, 1996. Foliar applications were made on July 22, Aug. 1,13, and 22 using a specialized small plot research CO_2 sprayer with a two-nozzle hand-held boom that delivered 200 L/ha of spray mixture. Assessments were taken by rating insect feeding damage per plot on Aug. 15, 20, and Sept. 11. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: THIODAN 4EC provided the highest and most consistant level of insect control throughout the season (Table 1.). Flea beetle populations were extremely heavy late in the season. LORSBAN 4E and CYMBUSH 250EC provided excellent mid-season insect control. DIPEL 2XDF gave good mid-season control of the Imported Cabbageworm but did not control the flea beetle populations during the later part of the season. VYDATE appeared to be more effective on flea beetles than the cabbageworm. SEVIN XLR PLUS was moderately effective on both insects while ADMIRE 240FS, RH-5992 240F, METASYSTOX-R 240SC, and CYGON 480E were efficacious.

Table 1. Foliar damage ratings of imported cabbageworm and flea beetle attacking rutabagas.

	Rates	Foliar Damage Ratings (0-10)*		
Treatments	L product/ha	Aug. 15	Aug. 20	Sept. 11
ADMIRE 240FS	0.1	6.3c**	4.8e	4.0e
ADMIRE 240FS	0.2	7.0bc	4.3e	5.5b-e
VYDATE L	3.0	6.8bc	6.3d	7.8a
RH-5992 240F	0.6	8.3ab	6.3d	7.6ab
METASYSTOX-R 240SC	2.25	8.0abc	6.5d	5.5b-e
CYGON 480E	0.7	7.5abc	5.0e	6.5abc
THIODAN 4EC	2.0	9.3a	9.6a	7.5ab
LORSBAN 4E	2.4	9.3a	8.6ab	5.5b-e
SEVIN XLR PLUS	2.5	7.5abc	7.0cd	6.3a-d
CYMBUSH 250EC	0.2	9.0a	9.1a	4.3de
DIPEL 2XDF	1.1	8.8a	7.9bc	4.8cde
Control		6.3c	4.0e	5.3cde

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly (P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 053 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Rutabaga, cv. Laurentian
PEST: Imported cabbageworm, *Artogeia rapae* (L), flea beetle, *Phyllotreta pusilla* (L)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: **USE OF ADMIRE AGAINST ROOT AND FOLIAR INSECTS IN RUTABAGAS**

MATERIALS: ADMIRE 240FS (imidacloprid), COUNTER 15G (terbufos), LORSBAN 15G (chlorpyrifos).

METHODS: Rutabagas were seeded in three-row plots, 8 m in length with rows spaced 0.75 m apart, replicated four times in a randomized complete block design. Plots were established at the Huron Research Station near Centralia on June 14, 1996. Granular applications were applied by hand in a 15 cm band over the row and raked into the soil immediately prior to planting. Assessments were taken by counting and/or rating insect feeding damage per plot on July 11, 30, Aug. 15, and Sept. 10. Plant emergence counts were taken on June 27. Results were analysed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: COUNTER 15G provided early-season control of flea beetles and moderate control of imported cabbageworms (Table 1). Plant emergence was not affected with the use of these insecticides. ADMIRE formulations and LORSBAN 15G were not effective in controlling flea beetles nor imported cabbageworms. Seedling emergence of rutabagas was not effected by any of the insecticide treatments.

Table 1. Seedling emergence and insect damage caused by flea beetles and imported cabbaworms attacking rutabagas.

Treatments	Rates prod/100m of Row	Emergence Counts Plants/plot June 27	Foliar Damage Ratings (0-10)* Cabbageworm larvae July 11	Aug. 15	Flea Beetles July 30	Sept.10
ADMIRE 240FS	8.33 ml	232.5a**	7.3a	4.2a	4.3cd	4.0a
ADMIRE 240FS	12.5 ml	242.8a	6.3b	4.0a	4.3cd	3.8a
ADMIRE 70WG	2.86 gm	231.5a	6.8ab	4.5a	5.3b	4.0a
COUNTER 15G	150.0 gm	242.0a	7.0a	6.2b	8.3a	4.0a
LORSBAN 15G	100.0 gm	238.8a	6.8ab	4.5a	5.0bc	4.3a
Control		212.3a	7.0ab	5.0ab	4.0d	4.3a

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** Means followed by the same letter do not differ significantly(P•0.05,Duncan's Multiple Range Test).

PMR REPORT # 054 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP Rutabaga, cv. Laurentian
PEST: Imported cabbageworm, *Artogeia rapae* (L)

NAME AND AGENCY:

PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: FOLIAR INSECT CONTROL WITH DIPEL Bt FORMULATIONS IN RUTABAGAS

MATERIALS: DIPEL WP and 2XDF (*Bacillus thuringiensis* var. *kurstaki*), XENTARI (*Bacillus thuringiensis* var. *aizawai* plus Lepidopteran active toxins)

METHODS: Rutabagas were seeded in three-row plots, 8 m in length with rows spaced 0.75 m apart, replicated four times in a randomized complete block design. Plots were established at the Huron Research Station near Centralia on June 14, 1996. Foliar applications were made on July 22, Aug. 1, 13, and 22 using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture. Assessments were taken by rating insect feeding damage per plot on July 30, Aug. 15, 20, and Sept. 11. Results were analysed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: The most effective formulation for the control of the imported cabbageworm (ICW) was DIPEL 2XDF, especially at the higher rate tested (Table 1). Control of the (ICW) with the lower rate of DIPEL 2XDF and DIPEL WP was similar. XENTARI provided an intermediate level of control relative to the other products tested. XENTARI was more effective than the DIPEL WP and the lower rate of DIPEL 2XDF formulations but was equal or slightly less effective than the higher or full rate of DIPEL 2XDF.

Table 1. Control of cabbageworm damaging rutabaga foliage.

Treatments	Rates kg pr/ha	Foliar Damage Ratings (0-10)* Aug. 15	 Aug. 20	 Sept. 11
DIPEL WP	1.1	8.0a*	6.5c	6.2a
DIPEL 2XDF	0.55	8.5a	7.5c	6.5a
DIPEL 2XDF	1.1	8.5a	9.0a	7.0a
XENTARI	1.1	8.8a	8.0b	7.5a
Control		5.8b	4.0d	4.0b

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control.

** means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 055 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006535

CROP: Field tomatoes, cv H9478
PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
PITBLADO R E
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: FOLIAR INSECTICIDE CONTROL OF COLORADO POTATO BEETLE IN FIELD TOMATOES

MATERIALS: GUTHION 240SC (azinphos-methyl), ADMIRE 240F and 70WG (imidacloprid),NOVODOR (*Bacillus thuringiensis* var. *tenebrionis*)

METHODS: The trial was located on a grower's field near Leamington, Ont. Tomatoes were transplanted in single, twin-row plots, 7 m in length with rows spaced 1.7 m apart, replicated four times in a randomized complete block design. Seedlings were transplanted with a commercial planter on May 31, 1996. The foliar applications were made using a specialized small-plot research CO_2 sprayer with a two-nozzle hand-held boom applying 200 L/ha of spray mixture on June 5 and 27. Assessments were taken by counting the number of CPB larvae and adults per plot on June 12, 21, and 26, and by foliage damage ratings caused by CPB feeding damage on July 17. Yields were taken on Sept. 10. Results were analyzed using the Duncan's Multiple Range Test (P•0.05).

RESULTS: Results are presented in the table below.

CONCLUSIONS: Foliar applications of ADMIRE provided excellent control of Colorado potato beetles (Table 1). All rates and formulations of ADMIRE gave similar beetle control than the present standard GUTHION 240SC. The 70WG formulation of ADMIRE at 68.6 gm prod/ha provided equal or better insect control than the highest rate of 200.0 ml of the 240F formulation. There was a non significant increase in insect control as the rates of ADMIRE were increased. The addition of NOVODOR to an application of ADMIRE did not result in an increase in efficacy. Tomato yields were not significantly different among the treatments and averaged 52 tonnes/ha.

Table 1. Colorado potato beetle counts and foliar damage ratings in tomatoes.

		Colorado Potato Beetle Counts/Plot			
Treatments	Rate product/ha	June 12 Adults	June 21 Larvae	June 26 Larvae	Foliar Damage Ratings (0-10)*
GUTHION 240SC	1.75 L	1.5a**	20.5a	66.3abc	6.5b
ADMIRE 70WG	68.6 gm	0.8a	2.5a	48.8c	8.0ab
ADMIRE 240F	200.0 ml	1.8a	15.0a	52.5bc	9.3a
ADMIRE 240F	100.0 ml	3.3a	5.0a	85.0abc	8.0ab
ADMIRE 240F	50.0 ml	1.0a	26.3a	83.8abc	7.5ab
ADMIRE 240F	25.0 ml	3.0a	25.0a	102.5abc	7.5ab
ADMIRE 240F	12.0 ml	3.5a	34.5a	127.5a	7.3ab
ADMIRE 240F; NOVODOR	25.0 ml; 4.0 L	1.8a	24.0a	118.8ab	7.0ab
ADMIRE 240F; NOVODOR	25.0 ml; 7.0 L	2.5a	21.8a	93.8abc	7.8ab
Control		1.0a	21.3a	110.0abc	2.5c

* Foliar Damage Ratings (0-10) - 0: no control, foliage severely damaged; 10: complete control. July 10.

** means followed by the same letter do not differ significantly(P•0.05, Duncan's Multiple Range Test).

PMR REPORT # 056 **SECTION B: INSECTS OF VEGETABLE AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Tomato, cv. H9478
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
TOLMAN J H, MOY P and McFADDEN G A
Agriculture and Agri-Food Canada, Pest Management Research Centre, 1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 ext. 232 **Fax**: (519) 457-3997 **E-mail**: tolmanj@em.agr.ca

TITLE: **EVALUATION OF EARLY-SEASON TREATMENTS FOR CONTROL OF COLORADO POTATO BEETLE ATTACKING PROCESSING TOMATO SEEDLINGS GROWN IN MINERAL SOIL**

MATERIALS: ADMIRE 240 F (imidacloprid), CYMBUSH 250 EC (cypermethrin).

METHODS: Tomato seedlings were grown singly in plastic propagation-plug trays each containing 12 rows of 24 plugs. On May 24, 72 hrs prior to planting, Tmt.

1 and 2 (Table 1.) were applied at 200 kPa in 900 L/ha using a single-nozzled (8004 flat fan) Oxford precision sprayer. Also on May 24, Tmt. 5 (Table 1) was applied at 150 kPa in 3.0 ml/plug using a single-nozzled (6506 flat fan) Oxford precision sprayer. Plants (13-15 cm tall) receiving Tmt. 5 were immediately flushed with 2-3 L water/tray to rinse the insecticide from the foliage and down into the planting medium of individual plugs. All treatments (20 plants/plot) were planted on the London Research Farm on May 27 in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. All treatments except Tmt. 6 received 150 ml starter fertilizer (soluble 10-52-10 [N-P-K] at 2.5 g/L) in the planting hole. The desired rate of ADMIRE was added to starter solution for Tmt.6. Individual seedlings were established in planting holes as soon as possible after adding planting water. Immediately after plants were established, Tmts. 3 and 4 were applied over the rows at 200 kPa in 900 L/ha using a single-nozzled (8002E flat fan) Oxford precision sprayer. As soon as spray deposits had dried on the foliage, a total of 6 leaves were harvested from each plot of each tmt. and returned to the laboratory for bioassay. Leaves were thereafter collected at regular intervals for further bioassay (Table 1). On each collection date a total of 9 bioassays (3 bioassays/plot x 3 plots/tmt.), each containing 2 leaves and 5 insecticide-susceptible CPB adults was established for each treatment. Bioassays were held at 25•C, 55% RH, and 16:8 L:D photoperiod. Mortality and leaf damage were recorded after 24, 48, and 72 hrs. To accommodate increasing growth, the centre row of plants was removed from each microplot on June 20. On May 30, to measure initial levels of imidacloprid in soil, soil cores (2.5 x 15 cm) were collected immediately adjacent to 5 plants slated for removal in Tmts. 2, 4-6, and 8. Similar samples were collected from beneath remaining plants on August 26. Plants were removed and plots were spaded and cultivated on September 4; random soil samples were then collected from the same treatments. On August 13, at first-ripe fruit, samples of ripe fruit were collected for residue analysis from Tmt. 2, 4-6, and 8. All residues of imidacloprid were determined using HPLC by the Analytical Chemistry Services Group in the London laboratory of the Pest Management Research Centre.

RESULTS: See Table 1. below. For the sake of brevity, only % reduction in damage to leaves by adults feeding in bioassays for 72 hrs is shown. No phytotoxicity was noted following treatment.

RESIDUES: Results of analyses of imidacloprid residues are shown in Table 2 below. The limit of detection for imidacloprid was 0.05 ppm. No imidacloprid residues were detected at any time in soil following PRF application of ADMIRE. Imidacloprid residues in soil 3 days following POF application of ADMIRE were at the threshold of detection. Low initial residues (0.19 ppm) of imidacloprid detected in soil beside transplants 3 days after DR application to plug trays had declined below the threshold of detection by Day 91. For PW application, imidacloprid residues in soil declined approximately 60% from Day 3 to Day 91. Tilling plots and the passage of 9 days resulted in a further 89% decline in soil residues, emphasizing the importance of soil dilution in dissipation of soil residues After tilling, soil residues of imidacloprid were at the threshold of detection. Analyses of possible residues in tomato fruit are incomplete.

CONCLUSIONS: Application of ADMIRE to foliage of tomato seedlings in plug trays 72 hrs prior to planting (Tmt. 1, 2) did not provide reliable post-planting protection of tomato seedlings from feeding damage by adult CPB.

Since, however, we observed good foliage-protection in some bioassays, we feel that uneven coverage tomato foliage in the very dense plug trays might have decreased overall plant protection in the field. POF application of both ADMIRE (Tmt. 3,4) and CYMBUSH (Tmt. 7) reduced damage to tomato foliage by at least 70% for 3 days; the higher rate of application of ADMIRE proved more persistent than the lower rate. Residues of imidacloprid in leaves of tomato seedlings subjected to drench application 72 hrs prior to planting (Tmt. 5) provided virtually complete control of CPB feeding damage to leaves harvested within 1 hr of planting and, with the exception of Day 10, reduced feeding damage by at least 90% for 14 days. While PW application of ADMIRE reduced CPB-feeding damage to leaves harvested 1 day after planting by over 55%, damage reduction did not exceed 95% until Day 7; damage reduction thereafter exceeded 80% until Day 22. From the grower's point of view, DR application of ADMIRE to plug trays prior to planting (Tmt. 5) appears to be the most effective method of tomato protection. Under weather conditions prevailing in 1996, seedlings were provided excellent protection from the time of transplanting until Day 14. By that date, plants had grown significantly and would have tolerated significant feeding by surviving overwintering CPB.

Table 1. Duration of foliage protection by an early-season application of insecticides to tomato seedlings.

No.	Treatment	Rate (g AI/ ha)	Method*	% Damage Reduction*** on Indicated Day**** Day 0	Day 1	Day 2	Day 3	Day 7	Day 10	Day 14
1	ADMIRE 240F	50.0	PRF	15.0	28.1	5.0	16.4	3.6	8.9	--
2	ADMIRE 240F	100.0	PRF	16.1	29.0	26.7	19.3	4.9	1.1	--
3	ADMIRE 240F	50.0	POF	91.0	85.9	74.1	79.7	0.2	22.7	--
4	ADMIRE 240F	100.0	POF	95.1	98.2	93.6	92.0	3.9	0.0	0.3
5	ADMIRE 240F	2.5**	DR	92.5	92.2	95.6	92.4	97.6	63.9	92.1
6	ADMIRE 240F	2.5**	PW	0.0	55.4	72.1	66.2	97.8	85.7	90.5
7	CYMBUSH 250EC	50.0	POF	94.9	94.0	62.0	86.1	45.8	18.4	4.7
8	CONTROL******	----	PW	10.0	10.0	10.0	10.0	10.0	10.0	9.9

No.	Treatment	Rate (g AI/ ha)	Method	% Damage Reduction on Indicated Day Day 22	Day 29	Day 36	Day 43	Day 49	Day 56
1	ADMIRE 240F	50.0	PRF	--*****--		--	--	--	--
2	ADMIRE 240F	100.5	PRF	--	--	--	--	--	--
3	ADMIRE 240F	50.0	POF	--	--	--	--	--	--
4	ADMIRE 240F	100.0	POF	--	--	--	--	--	--
5	ADMIRE 240F	2.5	DR	46.3	3.1	20.2	0.5	0.6	0.0
6	ADMIRE 240F	2.5	PW	82.6	50.0	46.5	9.8	19.6	4.0
7	CYMBUSH 250EC	50.0	POF	--	--	--	--	--	--
8	CONTROL	----	PW	9.6	9.9	9.5	9.3	9.5	9.7

* Methods of application: PRF - application to foliage in plug tray 72 hrs prior to planting; POF - banded application to foliage immediately after planting; DR - drench application to plug tray 72 hrs prior to planting; PW - planting water treatment.

** mg AI/plant.

*** relative to feeding damage in leaves from CONTROL plots (Tmt. 8).

**** days after planting

***** bioassay not undertaken due to lack of efficacy in earlier test.

****** actual 72-hour Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

Table 2. Pesticide residues measured in soil and tomato samples.

No.	Treatment	Rate (g AI/ ha)	Method*	Measured Residues (ppm) Soil Day 3	Soil Day 91	Soil Day 100	Tomato Day 78
2	ADMIRE 240F	100.0	PRF**	<0.05	<0.05	--	NA****
4	ADMIRE 240F	100.0	POF	0.05	<0.05	--	NA
5	ADMIRE 240F	2.5***	DR**	0.19	<0.05	<0.05	NA
6	ADMIRE 240F	2.5	PW	1.10	0.45	0.05	NA
8	CONTROL	---	---	<0.05			NA

* Methods of application: PRF - application to foliage in plug tray 72 hrs prior to planting; POF - banded application to foliage immediately after planting; DR - drench application to plug tray 72 hrs prior to planting; PW - planting water treatment.

** Add 3 days to Day Number for each residue determination.

*** mg AI/plant.

**** analysis not complete.

END OF SECTION B

SECTION C - **MEDICAL and VETERINARY**
/MÉDICAL et VÉTÉRINAIRE

- **Report/Rapport # 57 - 63**
- **Pages # 114-131**

Section Editor: **Dr. Doug Colwell**

PMR REPORT # 057 **SECTION C: MEDICAL AND VETERINARY INSECTS**
ICAR: 86100101

HOST: Beef cattle, mixed cross breeds
PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* (DeGeer)

NAME AND AGENCY:
HEAL J D, SURGEONER G A and LINDSAY L R
Department of Environmental Biology, University of Guelph
Guelph, Ontario N1G 2W1
Tel: (519) 824-4120 ext. 3966 **Fax**: (519) 837-0442
Email: jheal@evbhort.uoguelph.ca

TITLE: FIELD EVALUATION OF SABER™ EAR TAGS (10% LAMBDACYHALOTHRIN) FOR HORN FLY AND FACE FLY CONTROL ON BEEF CATTLE

MATERIALS: Plastic ear tags containing 10% w/w lambdacyhalothrin, Mallinckrodt Veterinary, Inc., 695 Westney Road South, P.O. Box 430, Ajax, Ontario, L1S 3C5.

METHODS: Three separate herds of beef cattle of mixed breeds (ca. 40-50 animals/herd) within two kilometres of each other near Elora, Ontario were used in this trial. Treated animals were tagged June 30, 1996. The herd treated with one tag per animal was pastured in separate fields in groups of three to six individuals. The herd treated with two tags per animal was held together on a mixed pasture/woodland. The third herd was not treated and served as a control. At approximately weekly intervals the number of horn flies per one side and the number of face flies per face were counted on ten randomly selected animals in each herd. Counts were made on the same day between 1300 h and 1700 h. Air temperature, wind speed and percent cloud cover were recorded during each sampling interval. Counts were not performed on unseasonably cool days or when high winds (>25 kph) or rain were present. Differences in the number of horn flies or face flies on animals between herds were determined using analysis of variance (ANOVA; $P \bullet 0.05$). Percent reduction of each fly species was determined for each weekly count and over the entire season by comparing the counts on each treated herd with the control herd.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: Saber™ ear tags(10.0% lambdacyhalothrin w/w) provided 100% control of horn flies and >80% control of face flies on beef cattle throughout the twelve week study period. There were no significant differences in protection between the herds treated with one or two tags per animal. There were no ill effects to animals noted.

Table 1. Number of horn flies per side on non-treated beef cattle and beef cattle tagged with one Saber™ ear tag (10% lambdacyhalothrin w/w) or two Saber™ ear tags near Elora, Ontario, 1996.*

Date	Days Post -treatment	Number of horn flies per side (± S.D.)		
		Non-treated	One tag	Two tags
June 23	-7	22.0 ± 15.3a	9.1 ± 9.8a	21.8 ± 15.0a
July 1	4	34.4 ± 20.3a	0.0 ± 0.0b	0.2 ± 0.4b
5	8	64.0 ± 29.0a	0.0 ± 0.0b	0.0 ± 0.0b
11	15	52.0 ± 29.5a	0.0 ± 0.0b	0.0 ± 0.0b
18	22	47.5 ± 25.0a	0.0 ± 0.0b	0.0 ± 0.0b
25	29	36.0 ± 17.9a	0.1 ± 0.3b	0.0 ± 0.0b
Aug. 1	36	64.5 ± 34.3a	0.0 ± 0.0b	0.0 ± 0.0b
9	44	57.1 ± 44.5a	0.0 ± 0.0b	0.0 ± 0.0b
15	50	78.5 ± 27.2a	0.0 ± 0.0b	0.0 ± 0.0b
23	58	62.5 ± 26.9a	0.0 ± 0.0b	0.0 ± 0.0b
30	65	38.5 ± 19.7a	0.0 ± 0.0b	0.1 ± 0.3b
Sept. 6	72	52.5 ± 30.2a	0.0 ± 0.0b	0.0 ± 0.0b
11	77	42.0 ± 23.8a	0.0 ± 0.0b	0.0 ± 0.0b
Season mean post-treatment:		52.5 ± 29.9a	0.0 ± 0.1b	0.0 ± 0.2b
Season mean percent control**:		---	100%	100%

* Counts based on ten animals per treatment, per sampling date; values within the same row followed by the same letter are not significantly different (P•0.05).

** Percent reduction =[(No. of flies on non-treated animals - No. of flies on treated animals)/No. of flies on non-treated animals] X 100%.

Table 2. Number of face flies per face on non-treated beef cattle and beef cattle tagged with one Saber™ ear tag (10% lambdacyhalothrin w/w) or two Saber™ ear tags near Elora, Ontario, 1996.*

Date	Dayst Post-treatment	Number of face flies per face (± S.D.)		
		Non-treated	One tag	Two tags
June 23	-7	19.1 ± 14.6a	16.1 ± 11.5a	9.9 ± 10.4a
July 1	4	5.4 ± 2.0a	0.4 ± 0.8b	2.7 ± 2.2c
5	8	4.1 ± 2.3a	0.1 ± 0.3b	0.1 ± 0.3b
11	15	4.2 ± 2.8a	0.2 ± 0.4b	1.0 ± 1.6b
18	22	17.6 ± 6.1a	0.2 ± 0.6b	2.1 ± 1.5b
25	29	21.6 ± 6.2a	2.2 ± 2.1b	2.3 ± 1.6b
Aug. 1	36	18.8 ± 8.4a	1.4 ± 1.9b	1.5 ± 1.8b
9	44	17.9 ± 9.1a	0.7 ± 0.7b	1.2 ± 1.4b
15	50	15.6 ± 6.4a	1.5 ± 2.0b	7.5 ± 5.1b
23	58	35.3 ± 10.9a	5.4 ± 4.0b	3.3 ± 3.7b
30	65	15.6 ± 6.1a	7.5 ± 6.8b	4.0 ± 4.0b
Sept. 6	72	6.2 ± 4.8a	2.0 ± 3.2b	1.7 ± 1.3b
11	77	6.6 ± 3.9a	2.0 ± 2.5b	3.3 ± 4.1ab
Season mean post-treatment :		14.1 ± 10.8a	2.0 ± 3.4b	2.6 ± 3.2b
Season mean percent control**:		---	85.8%	81.6%

* Counts based on ten animals per treatment, per sampling date; values within the same row followed by the same letter are not significantly different (P•0.05).

** Percent reduction =[(No. of flies on non-treated animals - No. of flies on treated animals)/No. of flies on non-treated animals] X 100%.

PMR REPORT # 058 **SECTION C: MEDICAL AND VETERINARY INSECTS**
ICAR: 86100101

HOST: Beef cattle, mixed cross breeds
PEST: Horn fly, *Haematobia irritans* (L.)

NAME AND AGENCY:
LINDSAY L R, HEAL J D AND SURGEONER G A
Department of Environmental Biology, University of Guelph
Guelph, Ontario N1**Tel**W1(519) 824-4120 ext. 3966 **Fax**: (519) 837-0442
Email: rlindsay@evbhort.uoguelph.ca
PARKS, V J
Ciba-Geigy Canada Ltd, 6860 Century Avenue, Mississauga, Ontario L5N 2W5
Tel: (905) 821-4420 **Fax**: (905) 567-0221
COLWELL D D
Agriculture and Agri-Food Canada, Lethbridge Research Centre
P.O. Box 3000, Main, Lethbridge, Alberta, T1J 4B1
Tel: (403) 327-4561 ext. 344 **Fax**: (403) 382-3156

TITLE: **EVALUATION OF RESISTANCE TO FENVALERATE AND CYPERMETHRIN BY HORN FLIES NEAR GLENCOE, ONTARIO**

MATERIALS: Glass tubes (36 ml) treated with Fenvalerate (0.00003 to 0.256 •g/cm^2) or cypermethrin (0.00003 to 2.048 •g/cm^2)

METHODS: On 25 August and 5 September, 1996, horn flies were collected with a sweep net from the backs and sides of animals tagged with the Stockaid® ear tags. Captured horn flies were transferred to 26 x 26 x 26 cm plexiglass cages, provided with water, and these cages were transported to the laboratory within 3 hours of capture. The level of resistance to fenvalerate only (28 August) and fenvalerate and cypermethrin (5 September) in horn flies collected from animals treated with Stockaid® tags were compared with that of susceptible flies collected from non-treated dairy cattle near Rockwood, Ontario.

The level of resistance in horn flies to the two pyrethroid insecticides was evaluated by assessing mortality of flies placed (groups of •20 flies) into 36 ml glass tubes treated with various concentrations of fenvalerate and cypermethrin (See Tables 1 & 2). Groups of 10 or 20 susceptible horn flies were exposed to the same concentrations of the two pyrethroid insecticides as the groups of flies collected from animals tagged with Stockaid® ear tags. The treated glass tubes used on 28 August were shipped from Agriculture Canada at Lethbridge, Alberta, to Guelph via courier and maintained at 8•C, prior to use. The tubes used on 5 September were coated with insecticide in the laboratory at Guelph and stored under the same conditions as the original shipment of tubes. When possible, each insecticide concentration was replicated twice (i.e. two tubes containing •20 horn flies each). Two hours after flies were placed in the tubes, the numbers of horn flies alive were counted. Flies which were not moving or were lying on their backs were considered dead. Evaluations were carried out at 22•C. During each assay, groups of 10-20 susceptible and resistant horn flies were also placed in tubes treated with acetone only (i.e., non-treated controls) to establish the level of natural fly mortality. The LD$_{50}$ for each insecticide was determined by solving for 50% mortality on the regression line for each insecticide concentration and percent mortality. Resistance ratios calculated as LD$_{50}$ of resistant strain / LD$_{50}$ of susceptible strain were also determined for fenvalerate and cypermethrin.

RESULTS: Horn flies collected from Stockaid® tagged animals on 28 August were exposed to 0.032, 0.064, 0.128 and 0.256 •g/cm^2 of fenvalerate and mortality was 100% at all concentrations except the 0.032 •g dose where 97.5% of the flies were killed. Because differential mortality of horn flies was not observed a second set of tubes coated with lower concentrations of fenvalerate (as well as a wide range of cypermethrin concentrations) was prepared. Horn flies collected on 5 September near Glencoe and exposed to 0.00003 to 0.256 •g/cm^2 of fenvalerate showed an LD$_{50}$ of 0.013 •g/cm^2 compared to an LD$_{50}$ of 0.00005 •g/cm^2 for susceptible flies from near Rockwood, Ontario (Table 1). The LD$_{50}$ of horn flies to fenvalerate was measured at 0.04 •g/cm^2 in 1994. The resistance ratio for fenvalerate was 249 in 1996 compared to a resistance ratio of 267 in 1994. Cypermethrin resistance was substantially higher than that observed for fenvalerate with an LD$_{50}$ of 0.183 •g/cm^2 compared to a LD$_{50}$ of 0.0003 •g/cm^2 for susceptible flies from near Rockwood, Ontario (Table 2). The resistance ratio for cypermethrin was also higher than fenvalerate at 634.

CONCLUSIONS: Based on weekly counts of horn flies (see Surgeoner et al. 1996, this section) and this resistance bioassay, horn flies collected from cattle near Glencoe have developed resistance to cypermethrin. In addition, resistance to fenvalerate (Surgeoner et al. 1994) has remained high in horn flies from this region. Cross-resistance imparted by fenvalerate resistance was likely partly responsible for the failure of the Stockaid® tags to successfully control horn flies. At the present time it is clear that producers can not return to using ear tags containing only synthetic pyrethroids to control horn flies on their animals. We recommend the use of tags that do not contain pyrethroids as the sole active ingredient (such as Eliminator® or Protector® tags) for control of horn flies in the Glencoe region of Ontario and we also suggest that producers remove these tags by mid-September to decrease the potential for resistance to the insecticides impregnated within these two types of tags.

REFERENCES:

Surgeoner, G.A., Lindsay, L.R., Heal, J.D., Parks, V.J., and Colwell, D.D. 1994. Evaluation of horn fly resistance to fenvalerate-impregnated ear tags near Glencoe, Ontario. Pest Man. Res. Rep. 142-143 pp.

Surgeoner, G.A., Lindsay, L.R., Heal, J.D., and Parks, V.J. 1996. Field evaluation of Eliminator®, Protector® and Stockaid® ear tags for control of face flies and pyrethroid-resistant horn flies on beef cattle near Glencoe, Ontario. Pest Man. Res. Rep. #60:XX-XX pp.

Table 1. Percent mortality following 2 hour exposures to various concentrations of fenvalerate of horn flies collected from beef cattle near Glencoe, Ontario treated with two Stockaid® (8% cypermethrin) ear tags and from non-treated dairy cattle near Rockwood, Ontario (i.e., susceptible), 5 September, 1996.

Concentration (•g/cm^2)	Glencoe horn flies **Resistant**	Rockwood horn flies **Susceptible**
0.256	100 (45/45)*	ND
0.128	100 (43/43)	ND
0.064	94.2 (49/52)	100 (22/22)
0.032	54.9 (28/51)	100 (20/20)
0.0156	43.5 (20/46)	ND
0.0078	7.8 (4/41)	100 (20/20)
0.0039	4.0 (2/50)	ND
0.0019	2.3 (1/44)	100 (20/20)
0.0009	0.0 (0/45)	100 (21/21)
0.0004	0.0 (0/41)	75.0 (18/24)
0.0002	0.0 (0/46)	45.4 (10/22)
0.0001	0.0 (0/46)	9.5 (2/21)
0.000061	0.0 (0/42)	8.3 (2/24)
0.000030	1.9 (1/52)	4.3 (1/23)
0.0	3.8 (2/53)	5.0 (1/20)

* Numbers in brackets are the total number of flies dead after 2 hours/number of flies exposed to each concentration. Percent mortality was obtained by multiplying this value by 100%. ND = not done.

Table 2. Percent mortality following 2 hour exposures to various concentrations of cypermethrin of horn flies collected from beef cattle near Glencoe, Ontario treated with two Stockaid® (8% cypermethrin) ear tags and from non-treated dairy cattle near Rockwood, Ontario (i.e., susceptible), 5 September, 1996.

Concentration (•g/cm^2)	Glencoe horn flies **Resistant**	Rockwood horn flies **Susceptible**
2.048	100 (51/51)*	ND
1.024	100 (46/46)	ND
0.512	95.5 (43/45)	ND
0.256	94.8 (55/58)	100 (20/20)
0.128	47.4 (28/59)	100 (24/24)
0.064	44.9 (22/49)	ND
0.032	19.0 (8/42)	100 (20/20)
0.0156	13.6 (6/44)	ND
0.0078	6.2 (3/48)	100 (20/20)
0.0039	4.1 (2/49)	100 (21/21)
0.0019	2.2 (1/46)	100 (19/19)
0.00097	0.0 (0/44)	85.0 (17/20)
0.00048	0.0 (0/58)	59.1 (13/22)
0.00024	1.7 (1/57)	50.0 (10/20)
0.00012	1.8 (1/55)	15.0 (3/20)
0.000061	2.0 (1/49)	8.7 (2/23)
0.000030	2.1 (1/47)	0.0 (0/20)
0.0	3.8 (2/53)	5.0 (1/20)

* Numbers in brackets are the total number of flies dead after 2 hours/number of flies exposed to each concentration. Percent mortality was obtained by multiplying this value by 100%. ND = not done.

PMR REPORT # 059 **SECTION C: MEDICAL AND VETERINARY INSECTS**
ICAR: 86100101

HOST: Beef cattle, mixed cross breeds
PEST: Horn fly, *Haematobia irritans* (L.)

NAME AND AGENCY:

LINDSAY L R, HEAL J D AND SURGEONER G A
Department of Environmental Biology, University of Guelph
Guelph, Ontario N1G 2W1
Tel: (519) 824-4120 ext. 3966 **Fax:** (519) 837-0442
Email: rlindsay@evbhort.uoguelph.ca
COLWELL D D
Agriculture and Agri-Food Canada, Lethbridge Research Centre
P.O. Box 3000, Main, Lethbridge, Alberta, T1J 4B1
Tel: (403) 327-4561 ext. 344 **Fax:** (403) 382-3156

TITLE: EVALUATION OF RESISTANCE TO TETRACHLORVINPHOS BY HORN FLIES NEAR PERTH, ONTARIO

MATERIALS: Glass tubes (36 ml) treated with tetrachlorvinphos (0.0009 to 5.0 •g/cm^2)

METHODS: In July 1996, a beef producer from near Perth, Ontario (•80 km southwest of Ottawa), complained of an apparent control failure when he observed 100 to 200 horn flies per side on his beef cattle tagged with Ectigard® (20% tetrachlorvinphos w/w) ear tags. On 30 August, 1996, horn flies were collected with a sweep net from the backs and sides of animals treated with one Ectigard® ear tag. Captured horn flies were transferred to 26 x 26 x 26 cm plexiglass cages, provided with water, and these cages were transported to the laboratory within 6 hours of capture. The level of resistance to tetrachlorvinphos in horn flies collected from animals treated with Ectigard® tags was compared with that of susceptible flies collected the same day from non-treated dairy cattle near Rockwood, Ontario.

Resistance to tetrachlorvinphos was evaluated by assessing mortality of horn flies placed (groups of •20 flies) into 36 ml glass tubes treated with various concentrations of the insecticide (Table 1). Groups of •10 or 20 susceptible horn flies were exposed to the same concentrations of the insecticide as the groups of flies collected from animals treated with Ectigard® ear tags. When possible, each insecticide concentration was replicated twice (i.e. two tubes containing •20 horn flies each).

Tubes were coated by placing 1 ml of each concentration of tetrachlorvinphos into a clean tube. Tubes were then rolled on a slanted horizontal surface until the insecticide had dried evenly within the tube. Treated tubes were stored for 2 days at 4-6 •C prior to use.

Two hours after flies were placed in the tubes, the numbers of horn flies alive were counted. Flies which were not moving or were lying on their backs were considered dead. The evaluation was carried out at 22•C. During the assay, groups of 10-20 susceptible and resistant horn flies were also placed in tubes treated with acetone only (i.e., non-treated controls) to establish the level of natural fly mortality.

RESULTS: The percentage of horn flies killed by exposure to the 9 concentrations of tetrachlorvinphos ranged from 7.3 to 40% for resistant horn flies (Table 1) and percent mortality of flies was not significantly correlated with increased insecticide concentration ($r=0.482$, $P=0.1884$). In contrast, nearly 100% of the susceptible flies were killed when exposed to the same range of tetrachlorvinphos concentrations as the resistant horn flies.

CONCLUSIONS: Based on the resistance bioassay, horn flies collected from cattle near Perth, Ontario have developed resistance to tetrachlorvinphos. Cross-resistance to organophosphates used in other ear tags (e.g., Diazinon in Protector® tags) will likely occur in this area of Ontario. We recommend the use of tags that do not contain organophosphates as the sole active ingredient (such as Eliminator® tags) for control of horn flies in the Perth region of Ontario.

Table 1. Percent mortality following 2 hour exposures to various concentrations of tetrachlorvinphos of horn flies collected from beef cattle near Perth, Ontario treated with one Ectigard® (20% tetrachlorvinphos) tag and from non-treated dairy cattle near Rockwood, Ontario (i.e., susceptible), 30 September, 1996.

Concentration (•g/cm^2)	Perth horn flies **Resistant**	Rockwood horn flies **Susceptible**
5.00	34.1 (14/41)*	100 (11/11)
3.33	38.8 (19/49)	100 (10/10)
0.99	31.2 (10/32)	100 (9/9)
0.44	40.0 (16/40)	100 (11/11)
0.20	34.8 (16/46)	100 (13/13)
0.064	23.4 (11/47)	100 (24/24)
0.0156	20.9 (9/43)	92.0 (23/25)
0.0039	7.3 (3/41)	92.6 (25/27)
0.0009	24.4 (10/41)	100 (20/20)
0.0	0.0 (0/25)	0.0 (0/17)

* Numbers in brackets are the total number of flies dead after 2 hours/number of flies exposed to each concentration. Percent mortality was obtained by multiplying this value by 100%.

PMR REPORT # 060 **SECTION C:** **MEDICAL AND VETERINARY INSECTS**
ICAR: 86100101

HOST: Beef cattle, mixed cross breeds
PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* (DeGeer)

NAME AND AGENCY:
LINDSAY L R, SURGEONER G A AND HEAL J D
Department of Environmental Biology, University of Guelph
Guelph, Ontario N1G 2W1
Tel: (519) 824-4120 ext. 3966 **Fax:** (519) 837-0442
Email: gsurgeoner@evbhort.uoguelph.ca
PARKS, V J
Ciba-Geigy Canada Ltd, 6860 Century Avenue, Mississauga, Ontario L5N 2W5
Tel: (905) 821-4420 **Fax:** (905) 567-0221

TITLE: FIELD EVALUATION OF ELIMINATOR®, PROTECTOR® AND STOCKAID® EAR TAGS FOR CONTROL OF FACE FLIES AND PYRETHROID-RESISTANT HORN FLIES ON BEEF CATTLE NEAR GLENCOE, ONTARIO

MATERIALS: Plastic ear tags containing: 11% diazinon and 6% cypermethrin w/w (Eliminator®); 20% diazinon w/w (Protector®) and 8% cypermethrin w/w (Stockaid®), Ciba-Geigy Canada Ltd, 6860 Century Avenue, Mississauga, Ontario, L5N 2W5.

METHODS: Four separate herds of beef cows of mixed breeds (25-80 animals per herd), located within four kilometres of each other, were used in this trial. From 12 to 13 June, 1996, animals in each herd were tagged (one tag per ear) with either: 2 Eliminator® tags, 2 Protector® tags, or 2 Stockaid® tags. A fourth herd was non-treated and served as a control. At approximately weekly intervals, the number of horn flies per one side and face flies per face were counted on ten randomly selected animals within each herd. Counts were made on the same day between 10:00 and 14:30 h on the four herds. Air temperature, wind speed and percent cloud cover were recorded during each sampling interval and counts were not performed on unseasonably cool days or when high winds (>25 kmph) or rain were forecast. Fly counts were made weekly from 21 June to 11 September (excluding pre-treatment counts) and a single count was also made on 25 September.

Differences in the number of horn flies or face flies on animals in the different herds were determined using analysis of variance and comparisons were made on weekly counts as well as pooled data for the entire season. The percent reduction in the numbers of each fly species provided by the different ear tags was also calculated for each weekly count and over the entire season using the formula: [[No. of flies on non-treated animals - No. of flies on treated animals]/No. of flies on non-treated animals] X 100%.

RESULTS: Animals tagged with the Eliminator® and Protector® tags had significantly fewer horn flies than animals in the non-treated herd during all weeks after tag application (Table 1). These two types of tags provided excellent control of horn flies throughout June, July and August. Although the number of horn flies on animals treated with these tags increased during September, at this time, both tag types still provided significantly better protection against horn flies than the Stockaid® tags. Over the entire season, the Eliminator® and Protector® tags provided a 99.1 and 98.7% reduction in horn flies, respectively, compared to the non-treated herd. In contrast, the Stockaid® tags provided satisfactory control of horn flies for the only first 3 weeks after tag application (Table 1). In the weeks after 5 July animals treated with Stockaid® tags had significantly more horn flies than the Eliminator® or Protector® herds. On three occasions, the number of horn flies on the non-treated herd and on the Stockaid® tagged animals were not significantly different. The number of horn flies on the Stockaid® group remained high even after animals were allowed access to dust bags containing 1% coumaphos (i.e., after 24 July). Over the entire season, the Stockaid® tags reduced horn flies by only 44.6% compared to the non-treated herd. Failure of the Stockaid® tags to control horn flies indicated that resistance to cypermethrin was prevalent among the horn flies feeding on animals in this treatment group (see Lindsay et al. 1996, this section).

The three types of ear tags provided adequate levels of protection against face flies during the first 2 weeks following tag application (Table 2), thereafter, with few exceptions, animals treated with either of the three tag types had similar numbers of face flies as the non-treated control herd. Over the entire season, the Eliminator®, Stockaid® and Protector® tags provided a 78.3, 74.3 and 40.6% reduction in face flies, respectively, compared to the non-treated herd. There were no ill effects noted in any of the tagged animals.

CONCLUSIONS: Over the entire season, Eliminator (11% diazinon and 6% cypermethrin) and Protector (20% diazinon) ear tags provided >98% control of horn flies although the number of horn flies on animals treated with the these tags increased during September. Stockaid® (8% cypermethrin) ear tags provided <45% reduction in horn flies on treated animals suggesting that horn flies have developed resistance to cypermethrin. In the Glencoe area in 1994, horn flies were shown to be resistant to the synthetic pyrethroid, fenvalerate, impregnated within Bovaid® ear tags (Surgeoner et al. 1994). Because of this apparent resistance, producers in the Glencoe area should not use tags in which synthetic pyrethroids are the sole active ingredient.

REFERENCES:

Surgeoner, G.A., Lindsay, L.R., Heal, J.D., Parks, V.J., and Colwell, D.D. 1994. Evaluation of horn fly resistance to fenvalerate-impregnated ear tags near Glencoe, Ontario. Pest Man. Res. Rep. 142-143 pp.

Lindsay, L.R., Heal, J.D., Surgeoner, G.A., Parks, V.J., and Colwell, D.D. 1996. Evaluation of resistance to fenvalerate and cypermethrin by horn flies near Glencoe, Ontario. Pest Man. Res. Rep. # 58:XX-XX pp.

Table 1. Mean number (± SD) of horn flies, *Haematobia irritans*, on non-treated beef cattle and three separate herds tagged (2 tags per animal) with three different types of ear tags, June to September, 1996.

Sample date (Days post-treatment)	Treatment groups*			
	Non-treated	Eliminator®	Protector®	Stockaid®
June 11(-2)	19.8 ± 16.9a**	26.6 ± 23.4a	11.8 ± 8.4a	17.3 ± 12.1a
June 21(8)	72.1 ± 34.8a	0.0 ± 0.0b	1.2 ± 1.6b	9.1 ± 13.5b
June 28 (15)	66.6 ± 39.5a	0.0 ± 0.0b	1.0 ± 1.1b	14.5 ± 12.8b
July 5 (22)	67.0 ± 31.3a	0.0 ± 0.0b	0.6 ± 0.7b	14.9 ± 5.6b
July 12 (29)	66.7 ± 33.6a	0.0 ± 0.0c	0.4 ± 0.7c	36.9 ± 26.1b
July 18 (35)	111.5 ± 46.8a	0.2 ± 0.6c	0.1 ± 0.3c	42.4 ± 19.1b
July 24 (41)	73.7 ± 26.3a	0.0 ± 0.0b	0.3 ± 0.7b	57.3 ± 29.1a***
August 1 (49)	72.7 ± 29.1a	0.0 ± 0.0c	0.3 ± 0.5c	37.2 ± 19.0b
August 7 (55)	102.2 ± 23.3a	0.0 ± 0.0c	1.2 ± 1.2c	35.0 ± 18.3b
August 14 (62)	101.5 ± 22.3a	0.0 ± 0.0c	1.0 ± 1.2c	59.8 ± 25.8b
August 21 (69)	81.6 ± 30.1a	0.2 ± 0.6c	0.6 ± 0.7c	52.8 ± 31.4b
August 28 (76)	79.4 ± 28.5a	0.0 ± 0.0b	0.3 ± 0.5b	82.5 ± 21.8a
Sept. 5 (84)	91.1 ± 20.3a	0.3 ± 0.7c	0.8 ± 0.9c	62.2 ± 34.3b
Sept. 11 (90)	68.2 ± 26.3a	3.8 ± 4.4b	2.1 ± 2.8b	62.5 ± 16.0a
Sept. 25 (104)	46.3 ± 26.0a	5.1 ± 3.9b	4.1 ± 3.4b	42.6 ± 20.4a
Seasonal mean (post-treatment)	78.6 ± 33.8a	0.7 ± 2.2b	1.0 ± 1.7b	43.5 ± 29.4a
Seasonal mean percent reduction	---	99.1%	98.7%	44.6%

* Eliminator® - 11% diazinon and 6% cypermethrin w/w; Protector® - 20% diazinon w/w; Stockaid® - 8% cypermethrin w/w.

** Means are based on counts from one side of ten randomly selected animals in each treatment group and means within rows followed by the same letter are not significantly different (*P*•0.05; ANOVA).

*** Animals in the Stockaid® group were allowed access to dust bags containing 1% coumaphos in the weeks following 24 July.

Table 2. Mean number (± SD) of face flies, *Musca autumnalis*, on non-treated beef cattle and three separate herds tagged (2 tags per animal) with three different types of ear tags, June to September, 1996.

Sample Date (Days post-treatment)	Treatment groups*			
	Non-treated	Eliminator®	Protector®	Stockaid®
June 11(-2)	1.2 ± 0.9a**	1.0 ± 0.9a	1.6 ± 1.3a	0.7 ± 1.2a
June 21(8)	24.8 ± 17.1a	0.9 ± 0.8b	6.5 ± 5.3b	1.2 ± 1.4b
June 28 (15)	11.9 ± 7.4a	1.2 ± 2.1b	2.0 ± 1.3b	1.8 ± 1.8b
July 5 (22)	3.3 ± 2.3a	1.3 ± 1.6a	2.3 ± 2.3a	1.4 ± 2.5a
July 12 (29)	7.5 ± 3.4a	3.4 ± 2.3ab	4.3 ± 2.5bc	1.0 ± 0.9c
July 18 (35)	5.5 ± 3.7ab	1.3 ± 1.7b	9.5 ± 6.6ab	1.0 ± 1.3b
July 24 (41)	6.4 ± 5.8a	1.7 ± 1.1a	3.9 ± 3.8a	4.6 ± 2.9a***
August 1 (49)	19.8 ± 13.8a	0.5 ± 0.8b	9.2 ± 3.1b	0.8 ± 0.9b
August 7 (55)	17.6 ± 12.2a	5.0 ± 2.7c	16.2 ± 8.1ab	6.6 ± 4.2abc
August 14 (62)	9.1 ± 6.6a	6.7 ± 3.5a	12.2 ± 6.3a	6.1 ± 4.1a
August 21 (69)	7.6 ± 5.1a	1.2 ± 1.9b	3.8 ± 3.3ab	2.7 ± 1.2b
August 28 (76)	20.7 ± 6.3a	1.3 ± 1.1b	4.4 ± 2.5b	3.1 ± 3.0b
Sept. 5 (84)	9.2 ± 4.4a	4.4 ± 4.1a	9.3 ± 10.0a	5.8 ± 4.0a
Sept. 11 (90)	8.5 ± 5.8a	3.5 ± 2.3ab	6.1 ± 3.9ab	2.4 ± 2.2b
Sept. 25 (104)	0.4 ± 1.6a	0.7 ± 1.6a	0.7 ± 0.9a	0.6 ± 1.0a
Seasonal mean (post-treatment)	10.9 ± 10.4a	2.4 ± 2.8b	6.5 ± 6.3b	2.8 ± 3.2a
Seasonal mean percent reduction	---	78.3%	40.6%	74.3%

* Eliminator® - 11% diazinon and 6% cypermethrin w/w; Protector® - 20% diazinon w/w; Stockaid® - 8% cypermethrin w/w.

** Means are based on counts from the faces of ten randomly selected animals within each treatment group and means within rows followed by the same letter are not significantly different (*P*• 0.05; ANOVA).

*** Animals in the Stockaid® group were allowed access to dust bags containing 1% coumaphos in the weeks following 24 July.

PMR REPORT # 061 **SECTION C: MEDICAL AND VETERINARY INSECTS**
STUDY DATA BASE: 8909

CROP: Beef cattle
PEST: Cattle pests

NAME AND AGENCY:
FLOATE K D
Agriculture and Agri-Food Canada, Lethbridge Research Centre,
P.O. Box 3000, Lethbridge, Alberta T1J 4B1
Tel: (403) 327-4561 **Fax:** (403) 382-3156 **Email:** FLOATEK@EM.AGR.CA

TITLE: IVERMECTIN RESIDUES IN CATTLE DUNG: EFFECTS ON NON-TARGET ORGANISMS AND DUNG BREAKDOWN

MATERIALS: IVOMEC POUR-ON (IVERMECTIN)

METHODS: Control dung (0 wk post-application) was collected from heifers before they were treated with a topical dose of ivermectin (500 mcg/kg body weight). Dung was then collected 1-12 wk post-application for use in spring and fall trials in 1994. Dung was collected fresh and frozen at -40 oC. After collections were complete, dung was thawed and used to make 12, 500 ml pats for each collection date. Each pat was deposited on a layer of sand on a styrofoam plate. Plates were then placed 1 m apart in a grid pattern with treatments evenly distributed throughout. Pats were placed adjacent to a pasture with cattle to enhance the colonization of the pats by insects. After 5 days in the field, each plate and its associated pat was brought indoors and placed in individual cages held at room temperature. Numbers of insects emerging as adults from control pats (0 wk) were compared to the numbers of insects emerging as adults from each treatment group (1-12 wk). The experiment was repeated in 1995 using dung collected 0-16 wk post-application.

Pat degradation was monitored for 15 pairs of 1 litre pats deposited on native prairie near Lethbridge on May 29, 1995. One member of each pair was a control pat, made from fresh dung deposited by untreated cattle. The second member of each pair was a treatment pat, to which had been added a concentration of 1.6 ppm of ivermectin. Pats of each pair were separated by < 1 m and were protected from foraging birds by chicken wire enclosures. Two to five pairs of pats were removed from the field 20, 60, 80, and 340 days after deposition and measured for pat degradation. Degradation was measured as the portion of the pat (as a percent of total pat dry weight) degraded to a "sawdust" consistency.

RESULTS: Insect activity was significantly reduced in dung from by ivermectin-treated cattle (Tables 1,2,and 3). Reductions were observed for coprophagous flies, parasitic wasps, and both predaceous and coprophagous beetles. The species most affected were the flies, *Sepsis* sp. and *Coproica mitchelli*, eucoilid wasps, and the beetles, *Cercyon quisquilius* and *C. pygmaeus*. These results were consistent both within and between years.

Dung treated with ivermectin had not appreciably degraded after 340 days in the field. In contrast, about 40% and 80% of the dry weight of untreated dung pats had been degraded to the consistency of sawdust after 60 and 80 days in the field, respectively.

CONCLUSIONS: Application of ivermectin at recommended rates can reduce normal levels of insect activity in dung from treated cattle. Reduced insect activity may subsequently inhibit the degradation of dung voided by these animals. The report summarizes the results of "Floate, K.D. 1996. Ivermectin residues in cattle dung: effects on non-target organisms and dung breakdown. Final Report (Project #94-0542), Farming for the Future, Alberta Agricultural Research Institute, Edmonton, Albert, 63 pp."

Table 1. Spring trial, 1994. Numbers of insects emerging from dung pats voided by cattle before (0 wk) and 1-12 wk after topical application of ivermectin (500 mcg/kg BW). Analyses compare the control to each treatment within the same row. Control and treatment means lacking a common letter differ (P = 0.05, 12 pats/treatment). Pats placed in field on May 12, 1994. Taxa listed comprise 95% of the 16,445 insects removed from cages during spring trial.

		Weeks post-treatment						
Insect Taxon	Control (0 week)	1	2	3	4	6	8	12
DIPTERA (Flies)								
Coproica mitchelli	126a	2b	3b	3b	2b	3b	16a	16a
Crossopalpus sp.	4a	0.3b	0.1b	0.2b	0.2b	1a	2a	1a
Forcipomyiinae	30a	8a	4a	17a	1a	6a	1a	12a
Ischiolepta micropyga	26a	0.1a	1a	0a	1a	0.1a	1a	0.3a
Psychodidae	15a	1b	4a	0.1b	5a	10a	2b	1b
Sepsis sp.	78a	0.3b	0.1b	0b	0.1b	0b	0b	8b
Smittia sp.	0.4a	15a	4a	8a	0.2a	3a	4a	16b
Swammerdamella	9a	0.1b	1a	0.3b	0.3a	0.1b	1b	3a
HYMENOPTERA (Wasps)								
Eucoilidae	45a	0.5b	0.5b	0.2b	0.3b	0.4b	0.1b	0.3b
COLEOPTERA (Beetles)								
Aphodius granarius	0a	0a	0a	0.1a	0a	0a	12a	0.1a
Aphodius fimetarius	10a	0b	7a	4a	9a	28a	16a	7a
Aphodius vittatus	68a	0b	6b	2b	69a	47a	52a	10b
Cercyon quisquilius	9a	0.1b	0.1b	0b	0.1b	0b	0.3b	0.3b
Cercyon pygmaeus	28a	0.1b	0.2b	0.4b	3b	4b	6b	4b
Philonthus cruentatus	3a	0.1b	1a	1a	1a	1a	1a	0.1b
Platystethus americanus	20a	6b	18a	4b	4b	6a	27a	4b
Aleocharinae sp. "A"	8a	0.1b	0.5a	0.4b	1a	1a	1a	2a
Aleocharinae sp. "D"	14a	5a	16a	5a	6a	8a	11a	6a
TOTAL PER PAT	493	39	66	46	103	119	153	91

Table 2. Fall trial, 1994. Numbers of insects emerging from dung pats voided by cattle before (0 wk) and 1-12 wk after topical application of ivermectin (500 mcg/kg BW). Analyses compare the control to each treatment within the same row. Control and treatment means lacking a common letter differ (P = 0.05, 12 pats/treatment). Pats placed in field on August 15, 1994. Taxa listed comprise 95% of the 3,433 insects removed from cages during fall trial.

		Weeks post-treatment						
Insect Taxon	Control (0 week)	1	2	3	4	6	8	12
DIPTERA (Flies)								
Coproica mitchelli	12a	0b	0.2b	0b	0b	0.1b	0b	16a
Sepsis sp.	24a	0b	0b	0b	0b	0b	0b	9b
COLEOPTERA (Beetles)								
Platystethus americanus	7a	4a	11a	4a	3a	6a	2b	1b
Aleocharinae sp. "D"	52a	13b	32a	10b	30a	18b	16b	2b
TOTAL PER PAT	95	17	43	14	33	24	18	28

Table 3. Spring trial, 1995. Numbers of insects emerging from dung pats voided by cattle before (0 wk) and 1-16 wk after topical application of ivermectin (500 mcg/kg BW). Analyses compare the control to each treatment within the same row. Control and treatment means lacking a common letter differ (P = 0.05, 12 pats/treatment). Pats placed in field on May 16, 1995. Taxa listed comprise 89% of the 18,180 insects removed from cages during spring trial.

		Weeks post-treatment			
Insect taxon	Control (0 week)	1	2	4	6
DIPTERA (Flies)					
Adia sp.	9a	0a	0a	0a	0.2a
Coproica mitchelli	16a	0.1b	0.1b	0.2b	0.3b
Scathophaga furcata	8a	6a	11a	16a	7a
Scathophaga stercoraria	47a	11a	48a	9a	30a
Sepsis sp.	29a	0.2b	0b	0.1b	0b
COLEOPTERA (Beetles)					
Aphodius vittatus	52a	1b	11a	42a	69a
Philonthus sp.*	3a	3a	4a	0.1a	0.1a
Ptiliidae	18a	5a	3b	0.3b	1b
Platystethus americanus	1a	4a	1a	2a	2a
Aleocharinae sp. "A"	9a	0.2b	1a	0.4b	2a
Aleocharinae sp. "D"	0.3a	0.2a	0a	1a	0a
Aleocharinae sp. "P"	0.1a	1a	4a	0a	0.2a
TOTAL PER PAT	192	32	83	71	112

Table 3. (Continued)

	Weeks post-treatment				
Insect Taxon	8	10	12	14	16
DIPTERA (Flies)					
Adia sp.	0a	0a	0.3a	3a	4a
Coproica mitchelli	0b	0b	11a	2a	4a
Scathophaga furcata	2a	7a	2a	8a	6a
Scathophaga stercoraria	6a	11a	9a	12a	2a
Sepsis sp.	0b	0.1b	1b	17a	4b
COLEOPTERA (Beetles)					
Aphodius vittatus	48a	141a	18a	109a	48a
Philonthus sp.*	0.3a	1a	0.2a	0b	0.1a
Ptiliidae	2b	7a	2b	1b	1b
Platystethus americanus	9a	11a	6a	5a	1a
Aleocharinae sp. "A"	3a	6a	2a	7a	4a
Aleocharinae sp. "D"	7a	0a	2a	0a	0.5a
Aleocharinae sp. "P"	0a	4a	0.1a	0.3a	0a
TOTAL PER PAT	77	188	54	164	73

*(Inc. *P. Cruentatus*)

PMR REPORT # 062 **SECTION C: MEDICAL AND VETERINARY INSECTS**
STUDY DATABASE: 8909

HOST: Beef cattle (heifers, cross-bred)
PEST: Cattle grub, *Hypoderma lineatum* (De Vill.)

NAME AND AGENCY:
COLWELL, D D, LYSYK, T J, TORGUNRUD, S M and VERSOZA, S M
Paradocs Biological Research and Consulting Corporation
Lethbridge, Alberta **Tel:** (403) 381-2767

TITLE: EFFICACY OF DORAMECTIN 0.5% POUR-ON AGAINST FIRST INSTAR CATTLE GRUB (*Hypoderma lineatum*) AND IMPACT ON WEIGHT GAIN.

MATERIALS: Doramectin 0.5%, Pfizer Inc., Eastern Point Road, Groton, CT 06340 U.S.A.

METHODS: Thirty cross bred beef heifer calves were used to determine the efficacy of Doramectin Pour-On for the control of first instar *Hypoderma lineatum*. All calves originated from the same herd and were selected for the study on the basis of the presence of antibodies, as determined by ELISA. The calves were weighed on Day 0, and ranked by weight. Descending pairs were placed in replicates and within each replicate animals were assigned to treatment on the basis of a coin toss. Treatment 1 received calves received a topical application of doramectin (0.5%) at the rate of 500 •g/kg or 1ml/10kg. Treatment 2 received a topical application of saline at the rate of 1ml/10kg. Both treatments were applied in a single passage along the midline of the back from the withers to the tailhead. Treatments were applied on December 8. Calves in each treatment group were housed in separate, open feedlot pens that allowed for no contact between groups. Throughout the study the calves were fed to appetite on a growing ration composed of barley silage (85%) and barley (15%) with mineral premix.

All calves were palpated weekly for the until such time as the first larvae appeared in warbles on the back. Subsequent to the appearance of the first warbles all calves were examined at biweekly intervals. Larvae were expressed from animals at each examination and identified to species. The last palpation was conducted on Mar 25 and any remaining larvae were expressed. All heifers were weighed on the day of the last palpation (107 days post-treatment).

RESULTS: The summary of grub palpations is presented in Table 1. All the grubs recovered from the untreated cattle were identified as *Hypoderma lineatum*. The summary of weight gain information is presented in Table 2.

CONCLUSIONS: Doramectin 0.5% Pour-on formulation was 100% effective in controlling migrating first instar *Hypoderma lineatum*. The treatment improved average daily gain of heifers by an average of 0.1 kg.

Table 1. Grub palpation summary and percent control of *Hypoderma lineatum* in groups of calves treated with Doramectin Pour-On (500•g/kg) or saline.

	Doramectin			Saline		
Palpation Date	No. of Animals	No. with Grubs	Grub Counts Avg (range)	No. of Animals	No. with Grubs	Grub Counts Avg (range)
Jan 14	15	0	0 (0-0)	15	10	1 (0-3)
Jan. 28	15	0	0 (0-0)	15	13	4 (0-14)
Feb. 11	15	0	0 (0-0)	15	15	9 (1-26)
Feb. 25	15	0	0 (0-0)	15	15	11 (1-22)
Mar. 12	15	0	0 (0-0)	15	13	6 (0-18)
Mar. 25	15	0	0 (0-0)	15	11	2 (0-8)

Table 2. Average daily gains for calves treated with Doramectin Pour-On (500•g/kg) or saline for control of cattle grubs.

Treatment	Number of Animals	Average Daily Gain (Mean ± se) (kg)
Doramectin	15	0.88 (± 0.09)
Saline	15	0.78 (± 0.05)

Average daily gains were significantly different ($P<0.0311$)

PMR REPORT # 063 **SECTION C: MEDICAL AND VETERINARY INSECTS**

CROP: Beef cattle
PEST: Rocky Mountain wood tick, *Dermacentor andersoni* Stiles

NAME & AGENCY:
PHILIP, H G and LASHUK, L
Crop Protection Branch, B.C. Ministry of Agriculture, Fisheries & Food
200 - 1690 Powick Road, Kelowna, B.C. V1X 7G5
Tel: (604) 861-7211 **Fax**: (604) 861-7490 **Email**: hphilip@galaxy.gov.bc.ca

TITLE: EFFICACY OF IVOMEC SR BOLUS FOR CONTROL OF ROCKY MOUNTAIN WOOD TICK ON BEEF CATTLE

MATERIALS: IVOMEC SR BOLUS (1.72 g ivermectin/bolus), DELICE Pour-On (1.0% permethrin w/v), LINDANE EC (11% lindane w/v), 40 Herefrod-cross yearling steers.

METHODS: This field trial was conducted near Douglas Lake, B.C. Forty Hereford-cross steers (222-340 kg body weight) were treated in groups of ten on April 3, 1996 as they were held in a chute prior to being tagged in an ear with a numbered ID tag. The first ten steers were left as untreated controls. The second ten were each administered an IVOMEC SR Bolus using an appropriate balling gun; the third group of ten were each treated with DELICE Pour-On at a rate of 15 mL/45 kg body weight; and each steer in the last group of ten was treated with 1-2 L of 0.25% LINDANE EC along the backline from the poll to the tailhead. The steers were released into a 129 ha pasture which has been used for many years for tick control research. On April 8, 12, 17, 22, and 26, the steers were gathered and individually examined in a squeeze for live ticks which were recorded by sex and feeding engorgement by females (none, partial, complete). All ticks were removed once recorded except from IVOMEC-treated steers on sampling dates April 17 and 22. Ticks were left to determine if the number of partial and completely engorged female ticks would increase over a longer period than the usual 4-6 days required to complete engorgement.

RESULTS: The mean numbers of live, attached female Rocky Mountain wood ticks per animal in each treatment group are shown in Table 1. No ticks were found on any of the animals on April 8. No significant difference in the average number of ticks per animal was found among treatments on any of the subsequent sampling dates. There were significantly fewer ticks per animal in the treated groups compared to the control group on April 17 and significantly fewer ticks per animal on the LINDANE-treated animals compared to the control animals on April 22. Only one completely engorged female tick was found on an IVOMEC-treated animal even though the number of partially fed female ticks per animal increased from 0.5 to 2.8 from April 17 to 26. However few completely engorged ticks were found in the other groups (4,4, and 3 ticks for control, DELICE and LINDANE groups, respectively). There was no significant difference among the groups in the final average weight of the animals. The overall tick pressure was much less than experienced in previous field trials when more than half of the untreated animals were treated for tick paralysis and removed from the study.

CONCLUSIONS: The IVOMEC SR Bolus performed as well as the standard treatments (DELICE Pour-On and LINDANE EC) for protecting yearling beef steers from Rocky Mountain wood tick engorgement under the tick pressure present during this field study.

Table 1. Average number of live, attached female ticks per animal in each of the treatment groups on each of the sampling dates.*

Treatment	Apr 8	Apr 12	Apr 17	Apr 22	Apr 26	Ave Final wgt (kg)
Control	0	1.0	3.7a	2.5a	1.5	618.75
DELICE pour-on	0	0.0	1.2b	0.9ab	1.9	600.25
IVOMEC SR bolus	0	0.5	0.8b	4.2ab	4.6	630.65
LINDANE EC	0	0.3	1.5b	2.0 b	2.6	623.00
ANOVA P<0.05	-	ns	*	*	ns	ns

* Figures are the means of 10 animals. Numbers in a column followed by the same letter are not significantly different (Student-Neuman-Kuel's test, $P<0.05$).

END OF SECTION C.

SECTION D - CEREAL, FORAGE and OILSEED CROPS /CÉRÉALES, CULTURES FOURAGÈRES et OLÉAGINEUX

- Reports/Rapports # 64-67
- Pages # 132-141

Section Editor: Dr. Owen Olfert

PMR REPORT # 064 **SECTION D: CEREAL, FORAGE and OILSEED CROPS**
ICAR/IRAC: 86100104

CROP: Canola, cv. Hyola
PEST: Crucifer flea beetle, *Phyllotreta crucifera* (Goeze) and Striped flea beetle, *Phyllotreta striolata* (Fabr.)

NAME AND AGENCY:
SEARS M K and MCGRAW R R
Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1 **Tel:** (519) 824-4120, ext. 3567 **Fax:** (519) 837-0442
Email: msears@evbhort.uoguelph.ca

TITLE: CONTROL OF FLEA BEETLE IN CANOLA BY VARIOUS FORMULATIONS OF LAMBDA-CYHALOTRIN, TEFLUTHRIN, AND PREMIERE SEED TREATMENTS, 1996

MATERIALS: See Table 1.

METHODS: The seed treatments for this trial were pre-mixed by ZENECA AGRO Chemical. The appropriate amount of seed for each plot was taken from the mixture and placed in individual packets. Canola was seeded at a rate of 5 kg/ha in an early (May 16) and a later (June 19) planting. A 6-row, tractor-mounted cone seeder was used, that evenly delivered the treated seed packets to rows spaced 22.0 cm apart. The plots, replicated four times, were trimmed to 5.5 m after seedlings emerged. Shot hole readings were taken in the early planting 3, 5, 7, and 11 days after emergence, by evaluating the average damage on a three-plant grouping at ten separate sites in the second and fifth rows of each plot. In the later planting, these assessments were taken 3, 5, 9 and 12 days after seedling emergence. Each damage rating was done on the most recent stage of growth of the plant; damage on earlier tissue was ignored. In this way, the current efficacy of the treatment was being evaluated. Damage to the two innermost leaves was recorded as 0 = no damage, 0.5 = 12.5%, 1.0 = 25%, 2.0 = 50%, 3.0 = 75%, 4.0 = 100% of the leaf area consumed. Analysis of variance was performed on the mean of the ten observations per plot.

CONCLUSIONS: In the early planting, all treatments except PREMIERE LITE significantly reduced the level of flea beetle damage relative to the UNTREATED check three days after initial emergence (Table 2). By seven days after emergence, only plots treated with PREMIERE PLUS and PREMIERE LITE + FORCE CS protected the canola plants relative to the check. The PREMIERE PLUS treatment provided control up to 11 days after emergence. None of the products tested provided control of flea beetle damage 14 days after emergence.

In the later planting, the FORCE and PREMIERE PLUS formulations controlled flea beetle damage up to five days (Table 3). The lambda-cyhalothrin treatments had inconsistent results. All of the high rates of the three different formulations provided five days of control as did some of the lower rates. Nine and 12 days after plant emergence there was no difference in damage to the canola foliage in any of the treatments.

Table 1. Materials used for control of flea beetles on canola, 1996.

Treatments	mg AI/kg seed	Material
UNTREATED	-	-
PREMIERE LITE	1680	thiobendazol, thiram
PREMIERE PLUS	1680	thiobendazol, thiram, lindane
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2289 CS - 1X	1000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2289 CS - 2X	2000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2289 CS - 4X	4000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2406 CS - 1X	1000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2406 CS - 2X	2000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2406 CS - 4X	4000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2407 CS - 1X	1000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2407 CS - 2X	2000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
+ WF2407 CS - 4X	4000	+ lambda-cyhalothrin
PREMIERE LITE	1680	thiobendazol, thiram
FORCE CS	10000	+ tefluthrin

Table 2. Damage index* on canola foliage at various times after seedling emergence, early planting, 1996.

	Days after initial emergence of seedlings				
Treatments	3 **	5	7	11	14
UNTREATED	0.40a	0.47ab	0.78a	1.60a	1.59a
PREMIERE LITE	0.37ab	0.55a	0.55abc	1.92a	1.61a
PREMIERE PLUS	0.18d	0.26c	0.35bc	1.00b	1.69a
PREMIERE LITE WF2289 CS	0.19d	0.35abc	0.50abc	1.85a	1.84a
PREMIERE LITE WF2289 CS	0.23bcd	0.37abc	0.58abc	1.63a	1.46a
PREMIERE LITE WF2289 CS	0.17d	0.36abc	0.64abc	1.77a	1.71a
PREMIERE LITE WF2406 CS	0.21cd	0.36abc	0.49abc	1.95a	1.69a
PREMIERE LITE WF2406 CS	0.23bcd	0.39abc	0.50abc	1.66a	1.65a
PREMIERE LITE WF2406 CS	0.21bcd	0.40abc	0.50abc	1.77a	1.87a
PREMIERE LITE WF2407 CS	0.37ab	0.46abc	0.69ab	1.85a	1.53a
PREMIERE LITE WF2407 CS	0.17d	0.40abc	0.68ab	1.88a	1.76a
PREMIERE LITE WF2407 CS	0.20d	0.47ab	0.58ab	1.74a	1.79a
PREMIERE LITE FORCE CS	0.13d	0.30bc	0.29c	1.60a	1.80a

* See Methods for a description of the damage rating scale.

** Means in each column followed by a similar letter are not significantly different at P • 0.05 (Tukey's Studentized Range test).

Table 3. Damage index* on canola foliage at various times after seedling emergence, later planting, 1996.

Treatments	Days after initial emergence of seedlings 3**	5	9	12
UNTREATED	0.79a	0.89a	2.90ab	2.73ab
PREMIERE LITE	0.83a	0.72ab	3.17a	3.14a
PREMIERE PLUS	0.19e	0.45b	2.67b	2.61ab
PREMIERE LITE, WF2289 CS - 1X	0.30cde	0.60b	2.91ab	2.73ab
PREMIERE LITE, WF2289 CS - 2X	0.52b	0.72ab	2.90ab	2.38ab
PREMIERE LITE, WF2289 CS - 4X	0.43bcd	0.57b	2.83ab	2.89ab
PREMIERE LITE, WF2406 CS - 1X	0.49bc	0.58b	2.87ab	2.53ab
PREMIERE LITE, WF2406 CS - 2X	0.41bcd	0.64ab	2.77ab	2.30b
PREMIERE LITE, WF2406 CS - 4X	0.47bc	0.60b	2.63b	2.49ab
PREMIERE LITE, WF2407 CS - 1X	0.52b	0.68ab	2.85ab	2.99ab
PREMIERE LITE, WF2407 CS - 2X	0.42bcd	0.55b	2.93ab	3.12ab
PREMIERE LITE, WF2407 CS - 4X	0.39bcde	0.59b	2.80ab	3.02ab
PREMIERE LITE, FORCE CS	0.25de	0.54B	2.70b	2.91ab

*, ** see footnote of Table 2.

PMR REPORT # 065 **SECTION D: CEREAL, FORAGE and OILSEED CROPS#**
ICAR/IRAC: 86100104

CROP: Canola, cv. Hyola
PEST: Crucifer flea beetle, *Phyllotreta crucifera* (Goeze) and Striped flea beetle, *Phyllotreta striolata* (Fabr.)

NAME AND AGENCY:
SEARS M K and MCGRAW R R
Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1 **Tel:** (519) 824-4120, ext. 3567 **Fax:** (519) 837-0442
Email: msears@evbhort.uoguelph.ca

TITLE: CONTROL OF FLEA BEETLE IN CANOLA BY FIPRONIL, IMIDACLOPRID, AND LINDANE SEED TREATMENTS, 1996

MATERIALS: See Table 1.

METHODS: The seed treatments for this trial were pre-mixed by Rhone Poulenc Chemical. The appropriate amount of seed for each plot was taken from the mixture and placed in individual packets. Canola was seeded at a rate of 5 kg/ha in an early (May 16) and a later (June 5) planting. A 6-row, tractor-mounted cone seeder was used that evenly delivered the treated seed packets to rows spaced 22.0 cm apart. The plots, replicated four times, were trimmed to 5.5 m after seedlings emerged. Shot hole readings were taken in the early planting 3, 5, 7, 11, and 14 days after emergence, by evaluating the average damage on a three-plant grouping at ten separate sites in the second and fifth rows of each plot. In the later planting, these assessments were taken 2, 3, 4, 5, 10 and 17 days after seedling emergence. Each damage rating was done on the most recent stage of growth of the plant; damage on earlier tissue was ignored. In this way, the current efficacy of the treatment was evaluated. Damage to the two innermost leaves was recorded as 0 = no damage, 0.5 = 12.5%, 1.0 = 25%, 2.0 = 50%, 3.0 = 75%, 4.0 = 100% of the leaf area consumed. Analysis of variance was performed on the mean of the ten observations per plot.

RESULTS: Damage data are shown in Tables 2 and 3.

CONCLUSIONS: In the early planting, treatments with LINDANE, LINDTURB, and all of the rates of FIPRONIL controlled the flea beetle up to 11 days following seedling emergence (Table 2), A rate response for Fipronil was not observed. The IMIDACLOPRID treatment did not provide control of the flea beetle.

In the later planting, LINDANE and IMIDACLOPRID provided up to five days of control of flea beetle damage to the canola foliage (Table 3). The LINDTURB treatment provided ten days of protection. The FIPRONIL treatments showed mixed results but did provide some control of damage for five days when compared to the untreated control but the damage in these treatments exceeded 25%, which is unacceptable.

Table 1. Materials used for control of flea beetles on canola, 1996.

Treatments	Code	g AI/kg seed	Active Ingredients
EXP 80038C		3.0	iprodione
EXP 806070A		2.0	thiram
UNTREATED	CHECK	-	
EXP 80534A	LINDANE	20.0	iprodione, thiram, lindane
EXP 80534A	LINTURB	20.0	iprodione, thiram, lindane
COUNTER 5G		22.0	terbufos
EXPX 80038C	FIPRONIL 7.5	3.0	iprodione
EXP 806070A		2.0	thiram
EXP 80415A		7.5	fipronil
EXP 80038C	FIPRONIL 10	3.0	iprodione
EXP 806070A		2.0	thiram
EXP 80415A		10.0	fipronil
EXP 80038C	FIPRONIL 12.5	3.0	iprodione
EXP 806070A		2.0	thiram
EXP 80415A		12.5	fipronil
EXP 80038C	IMIDACLOPRID	3.0	iprodione
EXP 806070A		2.0	thiram
IMIDACLOPRID		15.0	imidacloprid

Table 2. Damage index* on canola foliage at various times after seedling emergence, early planting, 1996.

Treatments	Days after initial emergence of seedlings 3**	5	7	11	14
CHECK	0.24ab	0.52a	0.42a	0.63a	1.79a
LINDANE	0.16b	0.13c	0.08d	0.20b	1.99a
LINDTURB	0.14b	0.20bc	0.12d	0.19b	1.66a
FIPRONIL 7.5	0.23ab	0.26bc	0.25BC	0.37b	1.40a
FIPRONIL 10	0.19b	0.25bc	0.28bc	0.29b	1.93a
FIPRONIL 12.5	0.26ab	0.26bc	0.31abc	0.32b	1.85a
IMIDACLOPRID	0.36a	0.30b	0.39ab	0.41ab	1.89a

* See methods for a description of the damage rating scale.

** Means in each column followed by the same letter are not sgnificantly differentat P• 0.05 (Tukey's Studentized Range Test).

Table 3. Damage index* on canola foliage at various times after seedling emergence, later planting, 1996.

Treatments	Days after initial emergence of seedlings 2**	3	4	5	10	17
CHECK	0.50a	1.89a	1.95a	2.10a	2.74a	2.13a
LINDANE	0.18bc	0.57bc	0.87cde	0.85cd	2.27ab	1.85ab
LINDTURB	0.19bc	0.46c	0.48e	0.68d	1.74b	2.22a
FIPRONIL 7.5	0.37abc	1.06b	1.34bcd	1.12bcd	2.46a	1.44b
FIPRONIL 10	0.33abc	1.07b	1.41abc	1.31bc	2.56a	2.25a
FIPRONIL 12.5	0.39ab	1.06b	1.51ab	1.49ab	2.28ab	1.88ab
IMIDACLOPRID	0.14c	0.59bc	0.78de	0.89bcd	2.20ab	1.66ab

*, ** See footnote of Table 2.

PMR REPORT # 066 **SECTION D: CEREAL, FORAGE AND OILSEED CROPS**
STUDY DATABASE: 22330-1610-74-02
ICAR: 84100567

CROP: Canola, *Brassica rapa*
PEST: Root maggots, *Delia radicum, D. floralis*

NAME AND AGENCY:
WOODS D L
Northern Agriculture Research Centre, Box 29, Beaverlodge, Alberta, T0H 0C0
Tel: (403) 354 5117 Fax: (403) 354 8171 **Email:** woodsd@em.agr.ca
DOSDALL L M
Alberta Environmental Centre, PO Bag 4000, Vegreville, Alberta, T9C 1T4
Tel: (403) 632 8825 **Fax:** (403) 632 8379 **Email:** lloyd@aec.arc.ab.ca

TITLE: DEVELOPMENT OF ROOT MAGGOT RESISTANT CANOLA

BREEDING METHODS: The initial population was developed from an interspecific cross between a swede(rutabaga) (*Brassica napus* Swede Bangholm Mustiala) reported to be root maggot resistant, and canola quality *B. rapa* (cvs Eldorado and Eclipse), followed by backcrossing twice or three times to *B. rapa* (AC Sunshine or a derivative of it). Once fertile *B. rapa* types had been obtained a conventional recurrent selection program with selection pressure for root maggot resistance and canola quality traits (low glucosinolates and zero erucic acid) was conducted. The material evaluated for root maggot resistance in 1996 was in its second cycle of selection. Erucic acid content was near zero, and glucosinolates were reduced from rapeseed levels, but not quantified. Each entry evaluated in 1996 was the product of a single plant grown in the greenhouse over the winter of 1995/96.

MAGGOT SUSCEPTIBILITY EVALUATION: 200 entries were evaluated in the field as single rows 3m in length and spaced 20cm. As a check the variety AC Sunshine was planted every sixth row. This variety was used as the check as earlier trials indicated that this was one of the least susceptible varieties currently grown. In late August when the plants were mature, 75 plants from each AC Sunshine row and all plants of each entry row (typically 60-80 plants) were dug out. All roots were washed and rated for damage on a 0 to 5 scale as follows;
0 - no root damage
1 - small feeding channels on less than 10% of the taproot surface area
2 - 11-25% of the taproot surface area damaged by root maggot feeding channels
3 - 26-50% of the taproot surface area damaged by root maggot feeding channels
4 - 51-75% of the taproot surface area damaged by root maggot feeding channels
5 - 76-100% of the taproot surface area damaged by root maggot feeding channels.
Overall damage on an entry was expressed as the arithmetic mean of all observations.

RESULTS: Statistical analysis of the performance of each line is not possible for this design of trial, however the individual rows can be regarded as samples of the base population, and overall performance compared with that of the check line. Of more interest from a breeding perspective is the distribution of the individual lines. In this trial 170 of the 200 entries were less damaged by root maggot than was the check, with a distribution of damage as presented in Table 1.

CONCLUSIONS: Compared with AC Sunshine, it is clear that most entries exhibited genetic advance in terms of reduced susceptibility to infestation by root maggots. Results are encouraging in view of the greater susceptibility to root maggot attack of plants of *B. rapa* compared with those of *B. napus*. However, these data are preliminary because susceptibility may be influenced by plot size and by the availability of alternative host plant genotypes from which ovpositing females can select. Consequently, an accurate assessment of the value of this trait to canola producers is not anticipated for 2 to 3 years.

Table 1. Average root maggot damage rating for 200 breeding lines at Vegreville in 1996

Class	Number of lines	Sub total
<0.59	2	
0.60-0.69	4	
0.70-0.79	5	
0.80-0.89	3	
0.90-0.99	15	
1.00-1.09	23	
1.10-1.19	31	
1.20-1.29	13	
1.30-1.39	14	
1.40-1.49	23	
1.50-1.59	27	
1.60-1.69	10	170 (AC Sunshine rating 1.68)
1.70-1.79	3	
1.80-1.89	13	
1.90-1.99	6	
2.00-2.09	5	
>2.10	3	30

PMR REPORT # 067 **SECTION D: FORAGE, CEREAL AND OILSEED CROPS**
STUDY DATA BASE: 364-1221-8803

CROP: Spring wheat, cv. Roblin
PEST: Orange wheat blossom midge, *Sitodiplosis mosellana* (Gehin)

NAME AND AGENCY:
WISE I L
Agriculture & Agri-Food Canada, Winnipeg, Manitoba, R3T 2M9
Tel: (204) 983-1450, Fax: (204) 983-4604, Email: iwise@em.agr.ca

TITLE: ORANGE WHEAT BLOSSOM MIDGE CONTROL IN SPRING WHEAT WITH IMIDACLOPRID

MATERIALS: UBI 2667 (imidacloprid), VITAVAX (carbathiin), NTN 33893 2.5G, 240FS (imidacloprid)

METHODS: Spring wheat was seeded 29 May 1996 with a double disc press drill in a field at Glenlea, Manitoba, and in cylindrical containers, 4 cm in diameter and 20 cm long, in a growth cabinet. The seed in field plots was sown at a rate of 80 kg/ha to a depth of 3 to 4 cm in 17.5 cm row spacings. The field plots were 1.25 m by 5.0 m and were replicated 5 times in a randomized complete block design. The laboratory plots consisted of 1 plant/container, and were also replicated 5 times. Imidacloprid treatments were applied either as a seed dressing (SD) or an in-furrow granule (IG) treatment at seeding or as a postemergent (PE) application at head emergence. PE treatments in the field were applied with a CO2 backpack sprayer at a water volume of 220 L/ha and a pressure of 300 kPa, using D6-25 nozzles. In the greenhouse study, wheat heads were dipped in spray solutions for the PE treatments, and granules were weighed and added separately to each container. Five plants/treatment at head emergence were placed on a rack in a cage, and were arranged in a Latin square design. Fifty four adult midge females were added to the cage. Plants were kept in the cage for 8 days and then moved to a greenhouse. Wheat heads were removed from the plants and examined for larvae after 3 weeks. In the field study, ten wheat heads were randomly collected in each plot 2 weeks after spraying. The heads were dissected under a microscope and larvae or cast skins were counted. Plots were machine harvested when plants were mature, and the seed was dried and weighed. The number of larvae/wheat head and the yield in the plots were analyzed by Duncan's Multiple Range test.

RESULTS: Data for the field and laboratory studies are contained in Table 1 below.

CONCLUSIONS: Larval densities of the midge in wheat heads were not reduced with seed dressing or granular treatments of imidacloprid. Applications of imidacloprid at head emergence reduced larval densities in both the field and laboratory studies, but results were not significant. Yields were increased with SD and PE treatments in field plots, however results were significant only for 1 seed dressing treatment.

Table 1. The number of orange wheat blossom midge larvae in spring wheat heads treated with imidacloprid in field and laboratory studies.

Treatments	Rate (g ai/ha)	Application Method	Larvae/head		Yield (g/m^2)
			Lab	Field	
CHECK	-	-	0.9ab*	1.4a	313bc
UBI 2667 + VITAVAX	125	SD	-	1.4a	332abc
UBI 2667 + VITAVAX	50	SD	-	1.0a	351a
UBI 2667 + VITAVAX	25	SD	-	1.2a	329abc
NTN 33893 2.5G	250	IG	2.2a	1.4a	309c
NTN 33893 2.5G	500	IG	1.0ab	1.5a	325bc
NTN 33893 240FS	25	PE	0b	0.9a	327abc
NTN 33983 240FS	50	PE	0b	1.0a	336ab

* Means followed by the same letter are not significantly different (Duncan's MRT, $P>0.05$).

END OF SECTION D

SECTION E - ORNAMENTALS and GREENHOUSE
/PLANTES ORNEMENTALES et DE SERRE

- 0 reports in 1996/Il n'y a pas de rapports en 1996 en cette section

SECTION F - BASIC STUDIES/ÉTUDES DE BASE

- Reports/Rapports # 68-71
- Pages # 142-148 (end of file:96insect.rep)

Section Editor: **Stephanie Hilton**

PMR REPORT # 068 **SECTION F: BASIC STUDIES**
STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops
PEST: Weeds in horticultural crops

NAME AND AGENCY:
TU, C M
Agriculture and Agri-Food Canada, Pest Management Research Centre
1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 **Fax:** (519) 457-3997 **Email:** tuc@em.agr.ca

TITLE: EFFECTS OF HERBICIDES ON MICROBIAL POPULATIONS IN SOILS

MATERIALS: Technical (>96% purity) EPTC, monolinuron, simazine and tridiphane.

METHODS: The soils used were a sandy loam (3.1% organic matter, 47.5% moisture holding capacity (MHC), 0.23% kjeldahl nitrogen, pH 7.8) and an organic soil (48.3% organic matter, 162% MHC, 1.94% kjeldahl nitrogen, pH 7.4). The soils were collected randomly to a depth of 15 cm. The bulk samples were passed through a 2-mm sieve and analyzed for chemical and physical characteristics. Herbicides were applied to the soil at 10 µg active ingredient per gram of soil using a carrier sand. Untreated controls were included. Soil organic matter was determined by chromic acid titration. The pH was measured in a 1:5 soil:water suspension using model 10 glass-electrode pH meter. Soils treated with a nitrification inhibitor, nitrapyrin at 30 µg/g, the antibiotic, streptomycin at 100 µg/g and a germicide, $HgCl_2$ at 70 µg/g, an autoclaved soil and untreated controls were included to compare the effect of these treatments on soil microbial activities. Data are expressed on an oven-dry basis and are averages of triplicate determinations. The treated and untreated soils were incubated at 28°C in 236-ml milk bottles and were closed with 0.038-mm thick poly-ethylene film for 1 and 2 weeks for microbial populations. Moisture was maintained at 60 % of soil MHC. Numbers of microorganisms were counted by a soil-dilution plate technique. Sodium albuminate agar was used for bacteria and rose bengal-streptomycin agar for fungi.

RESULTS: The effects of different herbicides on populations of soil microflora in the soils are summarized in the table below. No inhibitory effect on bacterial colony counts with EPTC was observed for the first week in sandy loam soil. Remaining herbicides were inhibitory. $HgCl_2$ at 70 µg/g reduced bacterial populations significantly in the sandy loam soil for the first week. Simazine was inhibitory to bacteria for the first week in the organic soil. No significant inhibition of bacterial population was shown after 2 weeks in organic soil. With the exception of autoclaving, no inhibitory effect on fungal population in sandy loam soil for 1 week was observed in the herbicide treatments. Monolinuron and simazine were stimulatory to the growth of fungi in organic soil after 2 weeks.

CONCLUSIONS: The four herbicides had some effects on soil microbial populations. The results indicated that these herbicides will have no permanent deleterious effects on soil microorganisms.

Table 1. Microbial numbers as related to different treatments of sandy loam and organic soil

Treatment	Bacteria (x10^{5}/g soil)				Fungi(x10^{3}/g soil)			
	Sandy loam		Organic soil		Sandy loam		Organic soil	
	1	2	1	2	1	2	1	2
Control	181	96	259	41	136	28	311	299
Autoclaving	1*	1*	1*	1*	1*	1*	1*	1*
Streptomycin	155	178*	285	136	27	26	342	298
$HgCl_2$	134*	78	210	164	57	38	325	238*
Nitrapyrin	184	132	228	207*	40	24	310	254
EPTC	161	153*	204	307*	43	31	331	264
Monolinuron	135*	135	286	344*	31	30	352	413*
Simazine	118*	132	198*	284*	43	36	337	402*
Tridiphane	107*	101	242	227*	27	28	303	25

*Significantly different from control at 5 % level within each column.

PMR REPORT # 069 **SECTION F: BASIC STUDIES**
STUDY DATA BASE: 280-1452-9305

CROP: Horticultural Crops
PEST: Weeds in horticultural crops

NAME AND AGENCY:
TU, C M
Agriculture and Agri-Food Canada, Pest Management Research Centre
1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 **Fax**: (519) 457-3997 **Email**: tuc@em.agr.ca

TITLE: **EFFECTS OF HERBICIDES ON NITRIFICATION AND SULFUR OXIDATION IN SOILS**

MATERIALS: Technical (96% purity) EPTC, monolinuron, simazine, and tridiphane.

METHODS: A sandy loam soil (3.1% organic matter, 47.5% moisture holding capacity (MHC), 0.23% kjeldahl nitrogen, pH 7.8) and an organic soil (48.3% organic matter, 162% MHC, 1.94% kjeldahl nitrogen, pH 7.4) were used. Soils treated with a nitrification inhibitor, nitrapyrin at 30µg/g, the antibiotic, streptomycin at 100 µg/g and a widely used broad-spectrum germicide, $HgCl_2$ at 70 µg/g, an autoclaved soil and untreated controls were included with all tests for comparison. Data are expressed on an oven-dry basis and are averages of triplicate determinations. The treated and untreated soils were incubated at 28°C in 236-ml milk bottles, which were closed with 0.038-mm thick polyethylene film for 1 an 2 weeks for nitrification and 4 and 8 weeks for sulfur-oxidation. Moisture was maintained at 60% of soil MHC. Nitrification of ammonium-N from soil organic matter was determined by the phenol disulphonic acid method for nitrate and diazotization method with sulphanilic acid, anaphthylamine hydrochloride and sodium acetate buffer for nitrites. Oxidation of sulfur from soil organic compounds was studied by sulfur oxidation. Sulfate was determined turbidimetrically.

RESULTS: None of the herbicide treatments affected nitrification of ammonium from soil organic nitrogen during the first week of incubation. However, with the exception of EPTC in organic soil, all herbicides inhibited nitrification after 2 weeks in both soils. Nitrapyrin, $HgCl_2$, and autoclaving were inhibitory for 2 weeks in sandy loam soil. The nitrapyrin treatment obviously did not cause complete kill of nitrifying microorganisms in organic soil, despite complete distribution of the chemical in the system. The stimulatory effects of simazine and tridiphane on nitrification in organic soil after 1 wk showed similar effects to streptomycin, $HgCl_2$ and nitrapyrin. The herbicide treatments did not suppress the vigorous oxidation of soil sulfur compounds. All treatments stimulated SO_4 formation during the 8-wk periods in the sandy loam soil. Simazine and tridiphane also stimulated sulfur oxidation after 4 wk in the organic soil.

CONCLUSIONS: The four herbicides had some effects on soil microbial activities in nitrification and sulfur oxidation but they were short-lived.

Table 1. Effect of different treatments on nitrification and sulfur oxidation in sandy loam and organic soil.

Treatment	Nitrification**				Sulfur oxidation***			
	Sandy loam		Organic soil		Sandy loam		Organic soil	
Incubation Period (wk)	1	2	1	2	4	8	4	8
Control	12	7	2	330	12	11	69	126
Autoclaving	7*	3*	16*	91*	4*	5*	36*	16*
Streptomycin	10	6	3*	331	38*	54*	101	116
$HgCl_2$	11	4*	3*	336	26*	58*	110	111
Nitrapyrin	9*	2*	3*	353	53*	54*	124*	126
EPTC	13	4*	2	350	33*	63*	94	127
Monolinuron	13	5*	2	59*	34*	68*	98	106
Simazine	12	5*	3*	122*	31*	58*	126*	135
Tridiphane	12	5*	3*	144*	31*	48*	127*	128

* Significantly different from control at 5% level within each column.
** µg $(NO_2^- + NO_3^-)$-N/g soil; *** µg$(SO_4^=)$-S/g soil.

PMR REPORT # 070 **SECTION F: BASIC STUDIES**
STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops
PEST: Weeds in horticultural crops

NAME AND AGENCY:
TU, C M
Agriculture and Agri-Food Canada, Pest Management Research Centre
1391 Sandford Street, London, Ontario N5V 4T3
Tel: (519) 457-1470 **Fax:** (519) 457-3997 **Email:** tuc@em.agr.ca

TITLE: EFFECT OF HERBICIDES ON BIOMASS-C AND DENITRIFICATION IN SANDY LOAM AND ORGANIC SOIL

MATERIALS: Technical (96% purity) EPTC, monolinuron, simazine and tridiphane.

METHODS: A sandy loam soil (3.1% organic matter, 47.5% moisture holding capacity (MHC), 0.23% kjeldahl nitrogen, pH 7.8) and an organic soil (48.3% organic matter, 162% MHC, 1.94% kjeldahl nitrogen, pH 7.4) were used. Soils treated with nitrapyrin at 30 µg/g, an antibiotic, streptomycin at 100 µg/g and a germicide, $HgCl_2$ at 70 µg/g, an autoclaved soil and untreated controls were included for comparison. Data are expressed on an oven-dry basis and are averages of triplicate determinations. The treated and untreated soils were incubated at 28°C in 236-ml milk bottles and were closed with 0.038-mm thick polyethylene film. Soil biomass-C was determined by chloroform fumigation technique. Five grams soil were taken from each sample and placed in 120-ml glass vials. Half of the samples at 60% MHC was fumigated with $CHCl_3$ for 24h and other half was left unfumigated. After fumigation and removal of $CHCl_3$ and adjustment of the moisture content to 60% MHC, the soil was extracted with 20 ml 0.5 M K_2SO_4 on an orbital shaker. Unfumigated soil was extracted similarly. Organic-C content of the K_2SO_4 extracts was determined by the chromic acid titration. The reduction of NO_3^- and NO_2^- to nitrous oxide (N_2O) or nitrogen (N_2) gas was determined by denitrification. Twenty-gram soil samples were weighed into 100-ml serum bottles containing KNO_3 (5000µg nitrate-N/g soil) equipped with gas-tight butyl-rubber stoppers and sealed with an aluminum seal. The activity of the soil to denitrify nitrate was studied by determining the amounts of N_2O evolved. Gas analysis was carried out by a Varian model 3700 gas chromatograph equipped with a thermal conductivity detector and a Varian model 9176 recorder.

RESULTS: Nitrapyrin and EPTC in organic soil were inhibitory to the amount of biomass-C. Soil gaseous nitrogen loss from KNO_3 into atmosphere occurs primarily because N_2O and N_2 resulted from the reductive process (denitrification). None of the treatments reduced N_2O formation in the soil, except autoclaving which was inhibitory to denitrification throughout the study. However, a stimulatory effect on N_2O formation was observed with EPTC for 2 weeks and monolinuron for 1 week in sandy loam soil with simazine and tridiphane after 2 weeks in organic soil.

CONCLUSIONS: The herbicides studied had some effects on soil microbial biomass-C and denitrification but they were short-lived. The indigenous soil microorganisms apparently can tolerate these chemical used for control of soil weeds. The results indicated that these herbicides will have no permanent deleterious effects on soil microorganisms and their activities important in maintenance of soil fertility.

Table 1. Effect of different treatments on biomass-C and denitrification in sandy loam and organic soil.

Treatment	Biomass-C µg/g soil		Denitrification µg (N_2O)/g			
	Sandy loam	Organic soil	Sandy loam		Organic soil	
			Period of incubation (wk) 1	2	1	2
Control	119 ab*	3590 abc	16 def	13 cd	48 ab	48 c
Autoclaving	1 c	1 g	1 g	4 e	1 e	1 d
Streptomycin	154 ab	3898 abc	19 cde	22 abc	43 abc	152 abc
$HgCl_2$	108 ab	3898 abc	13 fg	14 cd	42 bcd	153 abc
Nitrapyrin	108 ab	280 f	14 efg	16 bcd	42 bcd	116 abc
EPTC	108 ab	1776 e	22 abc	25 ab	44 abc	129 abc
Monolinuron	189 a	3030 abcd	20 bc	15 bcd	47 ab	104 bc
Simazine	108 ab	4205 a	21abcd	21abcd	46 abc	169 ab
Tridiphane	154 ab	3337 abcd	17 de	20 bcd	45 abc	172 ab

* Mean values within a column followed by the same letter do not differ significantly at 5% level determined by Duncan's multiple range test.

PMR REPORT # 071 **SECTION F: BASIC STUDIES**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk. and Onion Maggot Fly, *Delia antiqua* (Meigen)

NAME AND AGENCY:
MCDONALD, M R, HOVIUS, M H Y, JANSE, S, and VANDER KOOI, K
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: CORRELATION BETWEEN THE RESISTANCE OF ONION BREEDING LINES AND COMMERCIAL CULTIVARS TO THE WHITE ROT PATHOGEN, *Sclerotium cepivorum* BERK. AND THE ONION MAGGOT FLY, *Delia antiqua* (MEIGEN.).

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Dr. R. Maxwell, Petoseed, Asgrow Ltd., and 2 commercial cultivars Fortress and Norstar; Lorsban and 288 plug trays.

METHODS: See ICAR (# 206003) reports **"FIELD EVALUATION OF ONION LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *Sclerotium cepivorum* BERK."**, **"EVALUATION OF TRANSPLANTED ONION LINES FOR MAGGOT FLY RESISTANCE."** and **"EVALUATION OF SEEDED ONION LINES FOR MAGGOT FLY RESISTANCE."** for the methods. Data were analyzed using the Pearson Correlation function, significant at P=0.05, of the Linear Models section of Statistix, V. 4.1 and Spearman Rank Correlation function of the Association Tests section of Statistix, V. 4.1.

RESULTS: Correlation results are summarized in Tables 1 and 2.

CONCLUSIONS: Work by Esler and Coley-Smith (1983) suggested that the mechanism which initiates the germination of white rot sclerotia is linked to onion thiols and phenols and that those same chemicals attract onion maggot flies to the plant. Gabelman (1991) also suggested that there may be a significant correlation between white rot incidence and maggot fly damage in onions. No significant (P=0.05) correlation (Pearson) was found between white rot incidence and maggot fly damage using either transplanted or seeded data in 1996 (Table 1). When the Spearman Rank correlation was used a significant negative relationship (r=-0.54) was found between white rot incidence and harvest maggot fly damage (Table 2). It was unexpected that no correlation was found (either Pearson or Spearman Rank) between the maggot fly damage from the transplanted onions and the seeded onions. The relationship between white rot incidence and maggot fly damage in onions needs further investigation.

Table 1. Pearson Correlation between the resistance of onion lines and commercial cultivars to the white rot pathogen and onion maggot fly using white rot incidence (WRI) harvest data (%) and maggot fly damage data (%) from the transplanted (T) and seeded (S) maggot fly trials using 1st generation (1st), harvest (H) and total damage (TD) assessments.

	WRI	T-1st	T-H	T-TD	S-1st	S-H
T-1st	-0.16					
P-value	0.54					
T-H	-0.09	0.69				
P-value	0.74	0.002				
T-TD	-0.14	0.95	0.88			
P-value	0.58	0.000	0.000			
S-1st	0.16	0.02	0.07	0.04		
P-value	0.53	0.94	0.80	0.88		
S-H	-0.46	0.28	-0.16	0.12	0.29	
P-value	0.06	0.27	0.54	0.64	0.26	
S-TD	-0.19	0.19	-0.06	0.10	0.80	0.80
P-value	0.47	0.47	0.83	0.70	0.000	0.000

Table 2. Spearman Rank Correlation between the resistance of onion lines and commercial cultivars to the white rot pathogen and onion maggot fly using white rot incidence (WRI) harvest data (%) and maggot fly damage data (%) from the transplanted (T) and seeded (S) maggot fly trials using 1st generation (1st), harvest (H) and total damage (TD) assessments.

	WRI	T-1st	T-H	T-TD	S-1st	S-H
T-1st	-0.02[*]					
T-H	-0.18	0.74				
T-TD	-0.08	0.93	0.92			
S-1st	0.003	0.15	0.35	0.27		
S-H	-0.54	0.02	-0.14	-0.06	0.21	
S-TD	-0.24	-0.02	-0.02	-0.01	0.65	0.79

[*] Reject H_o if $r_s > 0.399$ (n=18) for correlations between white rot data and maggot damage data and reject H_o if $r_s > 0.368$ (n=21) for all correlations between transplanted and seeded maggot damage data (Mendenhall and Beaver, 1990. pp. 688).

REFERENCES:

Esler, G. and J.R. Coley-Smith. 1983. Flavour and odour characteristics of species of *Allium* in relation to their capacity to stimulate germination of sclerotia of *Sclerotium cepivorum*. Plant Pathology. 32:13-22.

Gabelman, W.H. 1991. White rot and onion maggot. Proceedings of the National Onion Research Conference., Savannah, GA:147-151.

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Section Editor: **Ms. Leslie S. MacDonald**

PMR REPORT # 72 SECTION G: DISEASES OF FRUITS

STUDY DATA BASE: 402 1461 8605

CROP: Apple, cv. McIntosh
PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

NAME AND AGENCY:
SHOLBERG P L
Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre,
Summerland, British Columbia V0H 1Z0
Tel.: (250) 494-7711 **Fax.:** (250) 494-0755 **email:** SHOLBERGP@EM.AGR.CA

TITLE: **BAS 490 02F APPLE SCAB REDUCED SCHEDULE, 1995.**

MATERIALS: BAS 490 02F 50 WG (methyl methoxyiminoacetate), NOVA 40 WP (myclobutanil), Polyram 80 DF (metiram)

METHODS: The experiment was conducted at Kelowna, B.C. in a five-year-old McIntosh orchard owned by the Research Station. The experimental design was a randomized complete block with five replications. Each single tree replicate was separated by a barrier tree. The five treatments were applied until runoff with a gun sprayer operated at 517 kPa except the control that was untreated. Treatments were applied at tight cluster on April 19, pink bud on May 1, full bloom on May 12, and at petal fall on May 24. After this final treatment cover sprays of metiram were made on June 7, June 19 and June 30 on all replicates except the control trees. During the primary infection stage of apple scab infection periods occurred on May 10 and June 4. Foliage scab was evaluated on July 12 on 10 randomly selected shoots from each single tree replicate. Fifteen leaves on each shoot were individually examined for lesions and number of lesions per leaf were counted. The number of lesions per leaf was estimated when more than 10 occurred on a single leaf. Apple foliage was also examined for signs of phytotoxicity such as leaf curling or burning. Apples (25 per single tree replicate) were harvested on September 5 and brought to the laboratory for examination. Fruit with lesions and number of lesions on each fruit were recorded. These counts were converted to percent infected leaves and fruit and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan *K*-ratio *t*-test was used at *k*=100, which approximates *p*=0.05, for multiple comparison of means and estimation of the minimum significant differences between means.

RESULTS: BAS 490F at the 4.0, 6.0 and 8.0 grams of product per 100L of water were as effective as Nova in preventing apple scab lesions on leaves and fruit (Table 1).

CONCLUSIONS: BAS 490F at rates as low as 4.0 grams of product per 100L of water will control primary scab when disease pressure is low.

Table 1. Reduced rates of BAS 490F compared to Nova forapple scab control.*

Treatment	Rate (product 100L)	Infected Leaves (96)	Lesopms/ Leaf	Infected Fruit (%)	Lesions/ Fruit
Control		16.8a*	0.4a	22.5a	0.5a
BAS 490F	4.0g	2.8b	0.1b	0.0b	0.0b
BAS 490F	6.0g	4.1b	0.0b	0.0b	0.0b
BAS 490F	8.0g	2.3b	0.0b	0.0b	0.0b
Nova	10.0g	5.2b	0.1b	0.8b	0.0b

* Means within the same column followed by the same letter are not significantly different at *p*=0.05 as decided by the Waller-Duncan *K*-ratio *t*-test

PMR REPORT # 73 SECTION G: DISEASES OF FRUIT

CROP: Grape, *Vitis labrusca* cv. Niagara, *Vitis vinifera* cv. Chardonnay
PEST: Downy mildew, *Plasmopara viticola* (Berk. & Curt) Berl. & de Toni

NAME AND AGENCY:
MCFADDEN-SMITH W
Horticultural Research Institute of Ontario
Box 7000, Vineland Station, Ontario L0R 2E0
Tel: (905) 562-4141 **Fax**: (905) 562-3413 **Email**: mcfaddw@gov.on.ca

TITLE: USE OF PREDICTIVE MODELS FOR TIMING OF FUNGICIDE APPLICATIONS FOR CONTROL OF DOWNY MILDEW OF GRAPE, 1996

MATERIALS: RIDOMIL-MZ 72WP (metalaxyl 8% + mancozeb 64%) , RIDOMIL-COPPER 70WP (metalaxyl 10% + copper hydroxide 60%), RIDOMIL GOLD-MZ 68WP (metalaxyl 4% + mancozeb 64%), MAESTRO 75DF (captan), FOLPAN 50WP (folpet), DITHANE M-45 (mancozeb), FIXED COPPER (copper hydroxide 53%)

METHODS: The field study was conducted in a research vineyard of *Vitis labrusca* (cv. Niagara) and *V. vinifera* (cv. Chardonnay) at Vineland Station, Ontario, that was minimally sprayed for downy mildew in 1994-1995 and therefore had a high inoculum potential. The predictive models tested were DMCAST, developed in Geneva, New York and DMODEL, which is part of the AusVit expert system developed in Australia. A Campbell Scientific datalogger with sensors to measure temperature, relative humidity, leaf wetness and rainfall was located within the vineyard. Data collected from the datalogger was downloaded manually into the predictive models daily. Post-infection sprays were applied according to the recommendations of the different models in a replicated field trial. After a post-infection spray was applied, no further action was taken, despite the occurrence of subsequent infection periods, until 14 days after the application. Ridomil-MZ (Ciba Geigy) and Ridomil Gold-MZ (Ciba Geigy) were applied pre-bloom on different plots using the DMCAST model. Only Ridomil-MZ was used in the DMODEL plots. Post-bloom, all post-infection plots were sprayed with Ridomil-Cu (Ciba Geigy) until 66 days pre-harvest. During the 66 day pre-harvest interval, a protectant spray program was followed. An unsprayed check and a protectant spray treatment similar to that used by growers were also included. All shoots on each of 5 vines per plot in each of 4 replicates of each treatment on each variety were observed daily for the incidence of primary infection or phytotoxicity. Primary infections were also monitored by using "trap plants". Flats of seedlings of Niagara and Chardonnay with 5 unfolded leaves were placed on the vineyard floor and replaced on Monday, Wednesday and Friday. Retrieved flats of seedlings were incubated under high humidity and observed for sporulating lesions of downy mildew. Once primary lesions were observed, all leaves on twenty shoots per plot were examined weekly until August 23 for severity of downy mildew based on a 0-6 rating scale (0 = no downy mildew; 1 = 1% of leaf area affected; 2 = 3%; 3 = 9%; 4 = 25%; 5 = 50%; 6 > 50%). The percentage of leaves with downy mildew lesions was also determined at each sampling date.

RESULTS: DMCAST predicted primary infection on June 13 for Niagara and June 15 for Chardonnay. Ridomil-MZ/Ridomil Gold-MZ was applied on these plots on June 14 and 19, respectively. Primary infections were first observed on Niagara seedlings put out in the vineyard June 12 and retrieved on June 14. This verifies the predicted primary infection by DMCAST. Primary infections in the vineyard were observed on Niagara and Chardonnay on June 24. The first post-infection spray was not recommended by DMODEL until after lesions were observed in the vineyard. No symptoms of phytotoxicity were observed in any of the treatments. Disease incidence and severity and yield data are currently being analyzed.

PMR REPORT # 74 SECTION G: FRUIT

STUDY DATA BASE: 390 1252 9201

CROP: Strawberry, cvs. Rainier and Totem
PEST: Red Stele, *Phytophthora fragariae* C.J. Hickman var. *rubi*

NAME AND AGENCY:
BROOKES V R
Agriculture & Agri-Food Canada, PARC, Agassiz, B.C. V0M 1A0
Tel: (604) 796-2221 **Fax:** (604) 796-0359 **Email:** BROOKES@EM.AGR.CA

TITLE: EFFICACY OF RIDOMIL AND RIDOMIL GOLD AGAINST STRAWBERRY RED STELE, 1996

MATERIALS: RIDOMIL (metalaxyl 240 g/l), RIDOMIL GOLD (metalaxyl 480 g/l).

METHODS: The trial was conducted in growers fields in Langley, B.C. The fields were known to be infested with red stele. There were two strawberry varieties, Rainier and Totem. The rows were spaced 1.1 m apart. Each treatment was applied to 5 m x 0.5 m plots with 4 replications in a randomized block design. The treatments were applied as drenches in 2000 L water with a pressurized sprayer. RIDOMIL had been applied to all treatments in fall, 1995. Spring treatments were applied April 18, 1996. Plant heights were taken June 10. Yield data is based on 6 harvests taken from June 18 to July 5. A 4 m section was harvested from each plot. Following harvest the plants were dug and fresh weight taken.

RESULTS: There were no significant differences between treatments.

CONCLUSIONS: From previous data, fall treatments for *Phytophthora* control are more effective than spring treatments.

Table 1. A comparison of plant height (ht), plant weight (wt), marketable yield (yld) and size index in Rainier strawberries sprayed with RIDOMIL and RIDOMIL GOLD in 1996.*

Treatment	Rate (L prod/ha)	Plant ht (cm)	Plant wt (g)	Market yld (g)	Size Index (g wt of 25 berries)
Check	---	14.1a	4834.2a	1264.7a	120.0a
RIDOMIL	4.2	15.7a	5236.4a	1452.8a	138.0a
RIDOMIL GOLD	1.0	14.1a	4691.6a	1212.6a	110.9a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P < 0.05$).

Table 2. A comparison of plant height (ht), plant weight (wt), marketable yield (yld) and size index in Totem strawberries sprayed with RIDOMIL and RIDOMIL GOLD in 1996.*

Treatments	Rate (L prod/ha)	Plant ht (cm)	Plant wt (g)	Market yld (g)	Size Index (g wt of 25 berries)
Check	---	17.1a	6534a	1922.7a	127.2a
RIDOMIL	4.2	17.5a	6939a	2128.0a	133.7a
RIDOMIL GOLD	1.0	17.3a	6372a	1773.5a	130.7 a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P < 0.05$).

PMR REPORT # 75 SECTION G: DISEASES OF FRUIT

CROP: Saskatoon, *Amelanchier alnifolia* cv. Smoky
PEST: Rust, *Gymnosporangium clavipes* (Cooke & Peck)Cooke & Peck in Peck

NAME AND AGENCY:
JESPERSON G D and LASHUK L
BC Ministry of Agriculture, Fisheries and Food
200-1690 Powick Road, Kelowna, British Columbia V1X 7G5
Tel: (250) 861-7211 **Fax**: (250) 861-7490 **E-mail**: gjesperson@galaxy.gov.bc.ca

TITLE: **EFFICACY OF FOLIAR FUNGICIDE APPLICATIONS AND TIMING FOR CONTROL OF GYMNOSPORANGIUM RUST ON SASKATOON, 1996**

MATERIALS: FUNGINEX 190EC (triforine 190 g/L), NOVA 40W (myclobutanil 40%), TOPAZ 250E (propiconazole 250 g/L)

METHODS: The trial consisted of 8 treatments, each with 4 single bush replicates arranged in a randomized complete block design, and was located at Little Fort BC in a six-year old saskatoon orchard, cultivar Smoky. There was a single bush buffer between each plot. Fungicides were applied to drip with a hand pumped 'Back Pack 20', Plant Products Co. Ltd. sprayer with Tee Jet 8006 nozzles calibrated to apply 1.5 - 2.0 L/min. Spray schedules evaluated for NOVA and TOPAZ included 1, 2 or 3 applications at 12 day intervals. FUNGINEX was applied only once as per label instructions. All fungicide treatments were applied on April 21 (white tip). Second and third applications were made on

May 3 and May 15 (flowering), as outlined in Table 1. Berries were harvested July 2 and assessed for the presence of aecia.

RESULTS: Percent berry infection at harvest is summarized in Table 1.

CONCLUSIONS: Two to three applications of NOVA and three applications of TOPAZ provided significantly better control than the check.

Table 1. Percent rust infection on saskatoon berries at harvest.

Fungicide	Rate (g or mL product/L)	Dates of Application	Mean % Berries with rust
check	---	---	8.3 a*
FUNGINEX 190EC	0.9 mL/L	Apr. 21	6.6 ab
NOVA 40W	0.113 g/L	Apr. 21	5.6 abc
NOVA 40W	0.113 g/L	Apr. 21, May 3	4.6 bcd
NOVA 40W	0.113 g/L	Apr. 21, May 3, May 15	3.2 cd
TOPAZ 250E	1 mL/L	Apr. 21	6.3 abc
TOPAZ 250E	1 mL/L	Apr. 21, May 3	6.7 ab
TOPAZ 250E	1 mL/L	Apr. 21, May 3, May 15	1.9 d

* Numbers followed by the same letter are not significantly different according to Least Significant Difference Test (P=0.05)

PMR REPORT # 76 SECTION G: DISEASES OF FRUIT

CROP: Sour cherry (*Prunus cerasus* L.)
PEST: *Apiosporina morbosa* (Schwein.:Fr.)Arx (=*Dibotryon morbosum*) (Schwein.:Fr.)Theiss.&Syd.)

NAME AND AGENCY:
MCFADDEN-SMITH W
Horticultural Research Institute of Ontario
Box 7000, Vineland Station, Ontario, L0R 2E0
Tel: (905) 562-4141 **Fax:** (905) 562-3413 **Email:** mcfaddw@gov.on.ca
NORTHOVER J
Agriculture and Agri-Food Canada, Pest Management Research Centre
Box 6000, Vineland Station, Ontario L0R 2E0
Tel: (905) 562-4113 Fax: (905) 562-4335

TITLE: EPIDEMIOLOGY AND CONTROL OF BLACK KNOT IN SOUR CHERRY, 1994-1995

MATERIALS: BRAVO 82.5 DG (chlorothalonil), CAPTAN (Maestro 75DF and Captan 80 WDG), KUMULUS 80DF (sulphur).

METHODS: A fungicide efficacy experiment was conducted on mature sour cherry trees at Jordan Station, Ontario. Inoculum originated from sour cherry knots suspended in the canopy of each tree. The fungicides tested for efficacy in protecting trees were chlorothalonil (Bravo 82.5 DG, ISK Biosciences), captan (Maestro 75DF, Zeneca Agro; Captan 80 WDG, Makhteshim-Agan) and sulphur (Kumulus 80DF, BASF). Simultaneously and in the same block, a spray program was carried out to investigate the effect of date of application of protectant sprays of captan (Maestro 75DF). Five, four, three, two and one applications were made on the dates indicated in Table 2. Shoots were examined monthly through the winter of 1994-1995 and weekly in the spring of 1995. In March, 1995 before knots started to develop, several limbs between 1 and 1.7 m high were flagged on each tree. Knots were first observed as swellings on control trees on May 15 (full bloom) and continued to develop through the summer. In

November 1995, after leaf drop, 300 shoots of greater than 1 cm length were examined on each tree and the incidence of knots recorded as a percentage, as indicated in the table below. Because the percentage of infected shoots was very low even in the unprotected water check, total numbers of knots per tree were also counted in March 1996.

RESULTS: All the fungicides reduced the percentage of shoots with knots compared to the water check(Table 1). Only trees sprayed with Bravo or one of the two captan formulations had significantly fewer total knots per tree than the water check. Results of the timing study (Table 2) show that only trees receiving 4 or 5 sprays of Maestro had significantly fewer total knots per tree than the unsprayed check. This means that as long as shoots are protected for the two weeks after petal fall, fungicidal control of black knot is satisfactory.

Table 1. Efficacy of protectant fungicides for control of black knot on sour cherry, 1994-1995

Treatment	Rate kg/ha	Mean % of shoots with black knots*	Mean Total Knots/Tree
Bravo 82.5 DG	3.7	1.00 a**	34.25a
Captan 80WDG	3.75	1.75 a	59.75ab
Maestro 75DF	4	3.58 a	86.50ab
Kumulus 80DF	12	4.60 a	118.00 bc
Water	--	9.43 b	155.50 c

Spray dates were: May 18 (full bloom), May 27 (petal fall), June 7 (fruits 1-1.5 cm diameter, terminal shoots 5-10 cm),June 16 (terminal shoots 20 cm) and June 28 (terminal shoots 25 cm)

* Values represent the means of 4 replicates.

** Numbers followed by the same letter are not significantly different using the Student-Newman-Keuls multiple range test (P<0.05).

Table 2. Effect of timing of Maestro 75DF (4 kg/ha) application on control of black knot of sour cherry, 1994-1995

Treatment	Date Applied 1 2 3 4 5*	Mean % of shoots with black knots**	Mean Total Knots/Tree
Maestro 75DF	+ + + + +	3.6 a***	54.7a
Maestro 75DF	- + + + +	2.8 a	61.0a
Maestro 75DF	- - + + +	2.9 a	101.8ab
Maestro 75DF	- - - + +	2.9 a	110.3ab
Maestro 75DF	- - - - +	14.6 c	207.7 c
Water	+ + + + +	9.4 b	155.5 bc

* Spray dates were: 1) May 18 (full bloom); 2) May 27 (petal fall); 3)June 7 (fruits 1-1.5 cm diameter, terminal shoots 5-10 cm); 4) June 16 (terminal shoots 20 cm); 5) June 28 (terminal shoots 25 cm)

** Values represent the means of 4 replicates.

*** Numbers followed by the same letter are not significantly different using the Student-Newman-Keuls multiple range test (P<0.05).

PMR REPORT # 77 SECTION G: DISEASES OF FRUIT

CROP: Strawberry, cv. Kent
PEST: Angular Leaf Spot, *Xanthomonas fragariae* Kennedy and King

NAME AND AGENCY:
APPLEBY M
Ontario Ministry of Agriculture, Food and Rural Affairs, R.R.#3, 95 Dundas St, Brighton, Ontario K0K 1H0 **Tel:** 613-475-1630 **Fax:** 613-475-3835
FISHER P A
Ontario Ministry of Agriculture, Food and Rural Affairs, Box 666, Woodstock, Ontario N4S 7Z5 **Tel:** 519-537-6621 **Fax:** 519-539-5351

TITLE: EFFICACY OF COPPER 53W FOR CONTROL OF ANGULAR LEAF SPOT ON STRAWBERRIES, PETERBOROUGH COUNTY, 1995

MATERIALS: COPPER 53W (copper from tri-basic copper sulphate 53 %)

METHODS: The trial was conducted in a 2-year old strawberry field near Lakefield, Ontario. Row spacing was 46 inches. Each treatment was applied to 4 plots of Kent. Plots were 8x15 m and arranged in a randomized complete block design. Treatments (COPPER 53W at 3.8 kg/ha) were applied May 6, (after mulch had been removed and new growth begun), May 15 and May 25 (before first bloom). The sprays were applied with a tractor-mounted boom sprayer, using 50 gallons of water per acre, at 50 psi. Disease control was evaluated on May 25 (pre-harvest) and July 11 (late harvest) by collecting 25 leaves per plot and rating each leaf according to the number of lesions per leaf: 0, 1-15, 16-50, 51 or more. A weighted score to indicate disease severity was calculated for each plot for each sample date using the following formula: Score = 0(# leaves with 0 lesions) + 1(# leaves with 1-15 lesions) + 2(# leaves with 16-50 lesions) + 3(# leaves with 50+ lesions). Data was analyzed using ANOVA.

RESULTS: Although angular leaf spot had been a problem in these plots in 1994, disease pressure was relatively low in 1995. There was no interaction between treatment and date, so data was pooled for analysis. ANOVA indicated no significant difference in the mean scores between copper-treated and untreated plots (p = .851). No phyto-toxicity was observed.

Table 1: Mean score* for angular leaf spot on leaves

Sample Date	Treatment	LSMean score*	P-value for pooled data
May 25	Control	4.3	.851
	COPPER 53WP	3.5	
July 11	Control	6.0	
	COPPER 53WP	3.0	

* higher score represents more disease

PMR REPORT # 78 **SECTION G: FRUIT**
STUDY DATA BASE: 390 1252 9201

CROP: Raspberry, cvs. Meeker and Tulameen
PEST: Raspberry root rot, *Phytophthora fragariae* var. *rubi*

NAME AND AGENCY:
BROOKES V R
Agriculture & Agri-Food Canada, PARC, Agassiz, B.C. V0M 1A0
Tel: (604) 796-2221 **Fax:** (604) 796-0359 **Email:** BROOKES@EM.AGR.CA

TITLE: **EFFICACY OF RIDOMIL AND RIDOMIL GOLD AGAINST RASPBERRY ROOT ROT, 1996**

MATERIALS: RIDOMIL (metalaxyl 240 g/l), RIDOMIL GOLD (metalaxyl 480 g/l).

METHODS: The trial was conducted on two established raspberry farms at Langley, B.C., one field with cv. Meeker and the other with cv. Tulameen. Both fields had a natural infestation of root rot. The raspberry rows were spaced 3 m apart. Each treatment was applied to 9.5 m x 1 m plots with 4 replications in a randomized block design. The treatments were applied as drenches in 2000 L/ha water with a pressurized sprayer. RIDOMIL had been applied to all treatments in fall, 1995. Spring treatments were applied April 18, 1996. Measurements were taken on Aug 6 and 7 for sucker height and Aug 15 and 16 for sucker diameters. Yield data is based on 11 harvests taken from July 10 to August 2. Four clones of Meeker were harvested in each plot and the entire plot of Tulameen was harvested.

RESULTS: There were no significant differences between treatments.

CONCLUSIONS: From previous data, fall treatments for Phytophthora control are more effective than spring treatments. Meeker is considered moderately resistant to root rot. This could account for the lack of difference between treatments. Tulameen is more susceptible to root rot than Meeker and there is a trend for better disease control with the two fungicide treatments. RIDOMIL and RIDOMIL GOLD will be applied to the same plots in fall 1996 and compared to an untreated control.

Table 1. A comparison of sucker height (ht), sucker diameter (diam), marketable yield (yld) and size index in Meeker raspberries sprayed with RIDOMIL and RIDOMIL GOLD in 1996.*

Treatments	Rate (prod/100 m row)	Sucker ht (cm)	Sucker diam (mm)	Market yld (g)	Size Index (g wt of 50 berries)
Check	---	177.5 a	8.6 a	6194 a	65.6 a
RIDOMIL	150 ml	174.0 a	8.2 a	6075 a	67.9 a
RIDOMIL GOLD	37 ml	167.4 a	8.1 a	5826 a	65.9 a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. A comparison of sucker height (ht), sucker diameter (diam), marketable yield (yld) and size index in Tulameen raspberries sprayed with RIDOMIL and RIDOMIL GOLD in 1996.*

Treatments	Rate (prod/100 m row)	Sucker ht (cm)	Sucker diam (mm)	Market yld (g)	Size Index (g wt of 50 berries)
Check	---	148.0 a	7.2 a	10290 a	122.3 a
RIDOMIL	150 ml	161.6 a	7.5 a	11305 a	123.0 a
RIDOMIL GOLD	37 ml	167.8 a	7.8 a	11442 a	128.5 a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

PMR REPORT # 79 SECTION G: DISEASES OF FRUIT

CROP: Strawberry, cv. Honeoye
PEST: Angular leaf spot, *Xanthomonas fragariae* Kennedy & King

NAME AND AGENCY:
DELBRIDGE RW and ARNOLD JR
Nova Scotia Department of Agriculture and Marketing, Kentville NS B4N 1J5
Tel: 902-679-6040 **Fax:** 902-679-6062

TITLE: CONTROL OF ANGULAR LEAF SPOT OF STRAWBERRY WITH FIXED COPPER AND DIFFERENT WATER VOLUMES

MATERIALS: CLEAN CROP COPPER 53% WP (tribasic copper sulfate)

METHODS: The experiment was conducted at Cambridge, NS in 1996, in a second year fruiting bed, cv. Honeoye. The experiment design was a randomized complete block with four replications. Each replicate consisted of one row, 5 meters long. Two rates of fixed copper were applied using a hand held pressurized CO_2 sprayer using either 1000 L or 2000 L water per ha at 207 kPa. Treatments were applied May 15 (blossom buds visible in crown), May 23 (20% bloom), June 3 (75% bloom) and June 10. Plots were assessed on June 20 by visually examining 75 leaflets and 25 fruit clusters per plot.

RESULTS: as presented in table below.

CONCLUSIONS: The higher rate of copper provided some control of angular leaf spot on strawberry leaflets but not on fruit calyces. The two water volumes used did not affect copper performance. No phytotoxicity was observed with any of the treatments.

Table 1. Percent leaflets & fruit calyces infected with angular leaf spot

Treatment	Rate (Product/ha)	Water Volume (L/ha)	% Infected Leaflets	% Infected Fruit Calyces
CLEAN CROP COPPER	2.5 kg	1000	32.7 ab*	16.1 a
CLEAN CROP COPPER	2.5 kg	2000	32.3 ab	8.6 a
CLEAN CROP COPPER	3.5 kg	1000	25.7 a	11.0 a
CLEAN CROP COPPER	3.5 kg	2000	27.0 a	8.1 a
Control (water)	--	1000	65.3 b	13.2 a

* Means followed by the same letter are not different P>0.05 according to the Waller-Duncan k-ratio t test after arcsine transformation of the square root of the data.

PMR REPORT # 80 SECTION G: DISEASES OF FRUIT

CROP: Strawberry, cv Honeoye, Jewel
PEST: Angular Leaf Spot, *Xanthomonas fragariae* Kennedy and King

NAME AND AGENCY:
FISHER P A
Ontario Ministry of Agriculture, Food and Rural Affairs, Box 666, Woodstock, Ontario N4S 7Z5 **Tel**: 519-537-6621 **Fax**: 519-539-5351

TITLE: EFFICACY OF COPPER 53W FOR CONTROL OF ANGULAR LEAF SPOT ON STRAWBERRIES, 1995

MATERIALS: COPPER 53W (copper from tri-basic copper sulphate 53 %)

METHODS: The trial was conducted in a 3-year old strawberry field near Thorndale, Ontario. Row spacing was 36 inches. Each treatment was applied to 4 Honeoye plots, 4 Jewel plots which had received a copper spray in fall 1994 and 4 Jewel plots which had not received a copper spray in fall 1994. Each plot was 18mX9m, arranged in a split plot randomized complete block design with treatment as the main effect and variety as the sub-plot. Treatments (COPPER 53W at 3.8 kg/ha) were applied May 1, (after mulch had been removed and new growth begun), and May 12 (before first bloom). The sprays were applied with a tractor-mounted boom sprayer, using 30 gallons of water per acre at 30 psi. Disease control was evaluated on May 19 (bloom), June 9 (pre-harvest) and June 19 (harvest) by collecting 50 leaves per plot and rating each leaf according to the number of lesions per leaf: 0, 1-15, 16-50, 51 or more. A weighted score to indicate disease severity was calculated for each plot for each sample date using the following formula: Score = 0(# leaves with 0 lesions) + 1(# leaves with 1-15 lesions) + 2(# leaves with 16-50 lesions) + 3(# leaves with 50+ lesions). Data was analyzed using ANOVA. Control was also evaluated by looking at the percentage leaves with no lesions. These values were transformed to logits (logit = ln((# + .75)/(50 - # + .75)) and analyzed using ANOVA.

RESULTS: Analysis of the weighted scores indicated a skewed distribution. Transformation (square root +1) provided a more normal distribution. ANOVA on the transformed data indicated a significant interaction for treatment x date and for variety x date. For all varieties, leaves from the control plots had a significantly higher score for disease than leaves from the copper-treated plots in June and July but not in May (Table 1).

Although differences in scores were significant, they may not have been large enough to provide economical disease control. The percentage of leaves apparently free from angular leaf spot lesions was significantly higher in the copper-treated plots than the control plots (Table 2). Even so, 40-60% of leaves were infected in the copper-treated plots.

Table 1: Mean score* for angular leaf spot on leaves

Sample date	Treatment	Mean score	95% Confidence limits**
May	Control	1.47	(0.28, 3.06)
	Copper	1.29	(0.15, 2.83)
June	Control	41.03	(35.49, 46.96)
	Copper	22.64	(18.54, 27.14)
July	Control	75.64	(68.10, 83.58)
	Copper	45.24	(39.43, 51.46)

* higher score represents more disease. Data was transformed for analysis, but the de-transformed means are reported here.

** Means are significantly different if the 95% confidence limits do not overlap.

Table 2: Percentage of leaves free from angular leaf spot lesions

Sample Date	Treatment	% clean leaves*	95% confidence limits**
May	Control	96.5	(95.3, 97.5)
	Copper	96.6	(95.4, 97.5)
June	Control	38.8	(31.4, 46.6)
	Copper	62.6	(54.8, 69.8)
July	Control	18.9	(14.5, 24.4)
	Copper	41.5	(33.9, 49.5)

* data was transformed to logits for analysis (logit = ln((# + .75)/(50 - # + .75)). The de-transformed means are represented here.

** Means are significantly different if the 95% confidence limits do not overlap.

PMR REPORT # 81 SECTION G: DISEASES OF FRUIT

CROP: Strawberry, cv. Cavendish, Jewel
PEST: Angular Leaf Spot, *Xanthomonas fragariae* Kennedy and King

NAME AND AGENCY:
FISHER P A
Ontario Ministry of Agriculture, Food and Rural Affairs, Box 666, Woodstock, Ontario N4S 7Z5 **Tel**: 519-537-6621 **Fax**: 519-539-5351

TITLE: EFFICACY OF COPPER 53W FOR CONTROL OF ANGULAR LEAF SPOT ON STRAWBERRIES, 1996

MATERIALS: COPPER 53W (copper from tri-basic copper sulphate 53 %)

METHODS: The trial was conducted in a 2-year old strawberry field near Thorndale, Ontario. Row spacing was 36 inches. Each treatment was applied to 4 Cavendish plots, and 4 Jewel plots. Each plot was 9mX9m, arranged in a split plot randomized complete block design with treatment as the main effect and variety as the sub-plot. Treatments (COPPER 53W at 3.8 kg/ha) were applied May 4, (after mulch had been removed and new growth begun), and May 25 (before first bloom). The sprays were applied with a tractor-mounted boom sprayer, using 30 gallons of water per acre at 30 psi. Disease control was evaluated on

June 7 (pre-harvest) and July 5 (late harvest) by collecting 50 leaves per plot and rating each leaf according to the number of lesions per leaf: 0, 1-15, 16-50, 51 or more. A weighted score to indicate disease severity was calculated for each plot for each sample date using the following formula: Score = 0(# leaves with 0 lesions) + 1(# leaves with 1-15 lesions) + 2(# leaves with 16-50 lesions) + 3(# leaves with 50+ lesions). Data was analyzed using ANOVA. Control was also evaluated by looking at the percentage leaves with no lesions. These values were transformed to logits (logit = ln((# + .75)/(50 - # + .75)) and analyzed using ANOVA.

RESULTS: There was no significant variation due to replicate, and there were no significant interactions between variety x treatment, and/or sample date. Significant effects are shown in Table 1. Jewel had a significantly more disease than Cavendish (p=.0012). Leaves from the control plots had a significantly higher score for disease than leaves from the copper-treated plots (p = .04290). Although differences in scores were significant, they may not have been large enough to provide economical disease control. The percentage of leaves apparently free from angular leaf spot lesions was not significantly higher (p= .09120) in the copper-treated plots than in the control plots. (Table 2).

Table 1: Mean score* for angular leaf spot on leaves

Variable	LSMean score	P-value
Control	60.31	.043
COPPER 53WP	45.06	
Cavendish	38.50	.001
Jewel	66.87	

* higher score represents more disease

Table 2: Percentage of leaves free from angular leaf spot lesions

Variable	LSmean*	95% confidence limits**
Control	18.4	(12.2, 26.7)
COPPER 53WP	28.68	(19.9, 39.4)
Cavendish	41.55	(30.5, 53.5)
Jewel	11.30	(7.3, 17.2)

* data was transformed to logits for analysis (logit = ln((# + .75)/(50 - # + .75)). The de-transformed means are represented here.

** Treatments are considered significantly different if the confidence limits do not overlap.

END OF SECTION G

SECTION H - PLANT PATHOLOGY/PHYTOPATHOLOGIE - VEGETABLES and SPECIAL CROPS /LÉGUMES et CULTURES SPÉCIALES

- Reports/Rapports # 82-107
- Pages # 161-209

Section Editor: Ray F. Cerkauskas

PMR REPORT # 82 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 344-1252-8671

CROP: Bean, White, cv. Centralia
PEST: Bean root rot; *Pythium ultimum; Fusarium solani; Rhizoctonia solani.*

NAME AND AGENCY:
TU J C and ZHENG J
Greenhouse and Processing Crops Research Center
Agriculture and Agri-Food Canada, Harrow, Ontario N0R 1G0
Tel: (519) 738-2251 **Fax**: (519) 738-2929 **Email**: Tum@em.agr.ca

TITLE: EVALUATION OF BIOAGENTS FOR ROOT ROT CONTROL OF BEAN, 1995

MATERIALS: *Gliocladium virens; Bacillus subtilis; Pseudomonas fluorescens.* Root rot fungi infested soil; greenhouse soil.

METHODS: The spore suspension of *Gliocladium virens (Gv)* was collected from 2-wk-old cultures grown on Potato-dextrose-agar (PDA). The spores were pelleted by centrifugation, resuspended in a small amount of sterile water and the fungal suspension was mixed with seeds (cv Centralia) to arrive a concentration of 1 x 10^5 colony forming units (cfu)/ seed. Two bacterial bioagents, *Bacillus subtilis* (Bs) and *Pseudomonas fluorescens* (Pf), were cultured in flasks containing nutrient-broth-yeast extract (NBY). The flasks were placed on a rotary shaker at 100 rpm at room temperature for 24 hours. The bacteria were centrifuged, resuspended in sterile water and mixed throughly with bean seeds to arrive a concentration of 5 x 10^7 cfu/seed. The control was water-treated seed (CK). All seeds were air-dried in a laminar-flow chamber and stored at 4°C for 12 hours before sowing. Seeds in each treatment were planted in 10cm x 10cm pots (10 seeds/ pot) filled with either greenhouse soil or root rot soil which was obtained from the root rot nursery at the Centre and was heavily infested with *Fusarium solani, Pythium ultimum* and *Rhizoctonia solani* at an estimated ratio of 3:2:5. After sowing, all the treatments were arranged in randomized complete blocks with 10 replications in a greenhouse at 22±2°C. The plant stand was counted two weeks after sowing and expressed as percent germination. Eight weeks after sowing, final plant stand, root rot severity and plant dry weight were assessed. Disease severity was assessed based on a 0-9 scale where 0=no disease symptom, 1= trace to 10%, 2= 11 to 20%, . . . , and 9= 81 to 100% of root surface with discoloration. The experiment was repeated once.

To evaluate the effect of bioagents on plant growth at various times after sowing, an additional 40 pots were planted in greenhouse soil for each of above treatments. All treatments were completely randomized in the greenhouse. At 3, 12, 24, 36 days after sowing, plants in 10 replicate pots were removed. The plant dry weight was recorded. The experiment was repeated once. The square root transformation was used for the percent germination and percent final plant stand. All data were analyzed for the homogeneity of variance and combined accordingly. Analyses were performed on the combined data using SAS PROC GLM. Fisher's protected least significant difference was used for mean separation.

RESULTS: Significant differences ($P=0.05$) among treatments were not detected for percent seed germination and final plant stand in both greenhouse soil and root rot soil and for plant dry weight in greenhouse soil (Table 1). However, the seeds that were treated with bioagents had higher germination rate and higher final plant stands than the control. This was especially evident in root rot soil where bioagents provided significant root rot control($P\leq 0.0001$) and resulted in an increase of plant dry weight ($P\leq 0.0002$). Gv was superior to Bs and Pf, it reduced root rot severity by 22%, and increased dry weight by 78% over the control.

Plant growth was affected significantly by bioagents in the early stages of growth. Dry weight of plants grown from bioagent-treated seeds was significantly lower than control at 3 ($P\leq 0.0001$), 12 ($P\leq 0.0017$) and 24 days ($P\leq 0.0192$) after sowing, respectively (Table 2). The results indicated that the emergence and growth were delayed in seeds with bio-treatments. However, at 36 and 48 days after sowing, the plants from bio-treated seeds surpassed the growth of those in the non-treated control.

CONCLUSION: The three bioagents tested were effective in controlling root rots of bean. They reduced disease severity and increased dry weight of plants in the root rot soil. Gv was among the best. In the greenhouse soil, however, the bioagents had little beneficial effects on plant emergence and growth since the greenhouse soil was free from infestation by root rot fungi. Also, bioagents applied to seed without carriers and diluents appeared to delay seed germination and seedling growth suggesting the need for a better coating technique.

Table 1. Effects of bio-seed treatments on plant growth and root rot severity of bean growing in greenhouse soil(GS) and root rot soil (RRS).

Treatment	Germination %		Plant stands %		Root rot severity*		Dry weight (g/pot)	
	GS	RRS	GS	RRS	GS	RRS	GS	RRS
Control	97.0a**	82.5a	96.0a	77.5a	0	4.49a	13.36a	5.02b
B.subtilis	99.5a	90.0a	99.5a	89.0a	0	3.76bc	12.87a	6.81a
G.virens	98.0a	86.0a	98.0a	86.0a	0	3.52c	14.09a	7.92a
P.fluorescens	99.0a	82.5a	98.5a	81.5a	0	4.08ab	12.99a	6.74a

* Figures represent the treatment means consisting of 20 replications or 200 seeds. Numbers followed by the same letter are not significantly different according to Fisher's Protected Least Difference Test (FLSD) at $P=0.05$.

** Disease severity was assessed based on a 0-9 scale where 0=no disease symptom, 1= trace to 10%, 2= 11 to 20%, . . . , and 9= 81 to 100% of root surface with discoloration.

Table 2. Effects of bioagents on plant dry weight of bean at various days after sowing in greenhouse soil.

Treatment	plant dry weight (g/10 plants) at days after sowing				
	3 days	12 days	24 days	36 days	48 days
Control	0.399a *	2.190a	6.250a	8.959a	1.282a
B.subtilis	0.098c	1.668b	5.280b	9.211a	1.292a
G.virens	0.289b	2.096a	6.598a	9.128a	1.448a
P.fluorescens	0.159c	1.732b	5.725ab	9.240a	1.320a

* Figures represent the treatment means consisting of 20 replications or 200 seeds. Numbers followed by the same letter are not significantly different according to Fisher's Protected Least Difference Test (FLSD) at P=0.05.

PMR REPORT # 83 SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS
ICAR #: 206003

CROP: Carrot cultivars: Six Pak and Huron
PEST: Cavity Spot, *Pythium intermedium* de Bary, *Pythium irregulare* Buisman and *Pythium sulcatum* Pratt & Mitchell

NAME AND AGENCY:
MCDONALD M R, SIRJUSINGH C and HOVIUS M H Y
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775-3783 **Fax:** (905) 775-4546

TITLE: **EFFECTS OF FUNGICIDE TREATMENTS AND SEEDING DATES ON CAVITY SPOT INCIDENCE AND SEVERITY.**

MATERIALS: RIDOMIL MZ 72WP (8% metalaxyl, 64% mancozeb)and RIDOMIL 2G (8% metalaxyl, 64% mancozeb); ALIETTE WDG (80% fosetyl-al)

METHODS: Carrots were seeded at the Muck Research Station (organic soil, pH 6.4, O.M. 60%), at 90-105 seeds/m with a 8cm shoe on a V-belt seeder at a 1.5cm depth. Seeding occurred on June 5 and 6 in rows 55cm apart on flat beds 35cm apart. A randomized complete block design with four replications per treatment was used. Cultivars (Huron and Six Pak) were randomized with in each block. There were 7 treatments, an untreated check, RIDOMIL MZ drench at seeding (2kg a.i./ha), ALIETTE WDG drench at seeding (25kg a.i./ha), ALIETTE WDG drench at seeding, July 1, August 1 and September 1 (6kg a.i./ha), RIDOMIL MZ drench 6 weeks after seeding (2kg a.i./ha), RIDOMIL 2G (215g/100m row) and a second seeding date (27 June 95). Recommended procedures for weed and insect problems were followed. Samples of 20 carrots were harvested from each replication every two weeks from Sept 8 to Nov 22. Samples were washed, tops removed and weighed and assessed for incidence (area under the disease progress curve for the growing season, AUDPC) and severity (area under the disease index curve for the growing season, AUDIC) of cavity spot. Cavity spot index was assessed as follows: very light <1mm, light 1-2mm, medium 2-5mm, heavy 5-10mm and very heavy > 10mm. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: As presented in the Tables 1 - 4.

CONCLUSIONS: Incidence of cavity spot over the season was higher on the cultivar, Huron than Six Pak, however there was no difference in the severity index between the two cultivars (Table 1). An application of RIDOMIL 2G six weeks after seeding significantly (P=0.05) reduced the incidence but not the severity (AUDIC) of cavity spot for Huron compared to the other treatments (Table 2). For Six Pak, the two treatments of ALIETTE WDG (drench at seeding and 4 drenches during the season) resulted in significantly lower cavity spot severity compared to the check (Table 3). The later seeding date also resulted in lower disease severity and disease incidence for both cultivars (Table 4). Cavity spot levels were high in all treatments this year, with incidence of 100% for much of the fall. Carrots have been grown in the same plot for cavity spot assessment for several years, which may have increased the inoculum concentration. Metalaxyl was applied to this area for several years therefore, some *Pythium* species may have developed resistance to this fungicide.

Table 1. Cavity spot incidence (AUDPC) and severity index (AUDIC) by cultivar.

Cultivar	AUDPC**	AUDIC***
Huron	7555.2 a*	2774.0 a
Six Pak	7435.2 b	2728.8 a

Table 2. Treatment effect on AUDPC and AUDIC for cv. Huron.

Treatment	AUDPC	AUDIC
RIDOMIL MZ, Drench at seeding	7600.0 a*	2809.8 a
RIDOMIL 2G, 215g per 100m of row	7600.0 a	2865.3 a
ALIETTE WDG, 4 drenches during season	7591.3 ab	2818.8 a
Check	7582.5 ab	2755.8 a
ALIETTE WDG, drench at seeding	7556.3 ab	2857.8 a
RIDOMIL MZ, 6 weeks after seeding	7535.0 b	2948.0 a

Table 3. Treatment effect on AUDPC and AUDIC for cv Six Pak.

Treatment	AUDPC	AUDIC
Check	7582.5 a*	2953.8 a
RIDOMIL 2G, 215g per 100m of row	7547.5 a	2920.3 ab
RIDOMIL MZ, 6 weeks after seeding	7565.0 a	2885.0 abc
RIDOMIL MZ, drench at seeding	7427.5 a	2869.0 abc
ALIETTE WDG, 4 drenches during season	7468.8 a	2731.8 bc
ALIETTE WDG, drench at seeding	7468.8 a	2701.3 c

Table 4. Seeding date effect on AUDPC and AUDIC by cultivar.

	Cultivar Huron		Cultivar Six Pak	
Seeded	AUDPC	AUDIC	AUDPC	AUDIC
June 5-6	7600.0 a*	2809.8 a	7582.5 a	2953.8 a
June 27	7421.3 b	2362.8 b	6986.3 b	2040.3 b

* Numbers in a table followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 84 SECTION H: **DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. CDC Expresso
PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca

TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT ON DRY EDIBLE BEANS: I. GREENHOUSE TRIALS WITH NATURALLY INFESTED SEED AT BROOKS, ALBERTA, IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP; equivalent to 50% streptomycin base), STREPTOMYCIN 17 (streptomycin sulphate 25.2% WP; equivalent to 17% streptomycin base), THIRAM 75 WP (thiram 75% WP), CHEM-COP 53 (tribasic copper sulfate 53% WP)

METHODS: CDC Expresso black bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* was treated with one rate of AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP, three rates of STREPTOMYCIN 17 + THIRAM 75 WP, one rate of CHEM-COP 53 + THIRAM 75 WP, and one rate of THIRAM 75 WP. The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 mL of water, and 13.0 mL of water was added to each portion of STREPTOMYCIN 17. Each chemical treatment (Table 1) was applied as a slurry to a separate, 1000 g lot of seed that had been commercially treated with THIRAM 75 WP. An additional lot of seed was treated with tap water as a control. In the laboratory, seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 1000 g of seed was run through the treater to pre-coat the drum with the respective chemical treatment in order to minimize adhesion losses during subsequent treatments. A sample of CDC Expresso bean seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP (1.0 g + 1.0 g) was obtained from a commercial seed treatment plant in southern Alberta for comparison with the laboratory-treated seed. On May 28, the treated and untreated seeds was planted in sterilized potting soil. Each treatment consisted of eight, 15 cm diameter pots (replications) with 25 seeds per pot. The pots were placed in a greenhouse at CDC South using a randomized complete block design. Emergence counts were done June 7 and 10, and the data were tabulated, arcsin transformed and subjected to ANOVA.

RESULTS: Treated bean seed germinated and emerged much better than untreated seed (Table 1). Mixing streptomycin with thiram significantly ($P \leq 0.05$) improved emergence, when compared to thiram alone, in three of the five cases where they were combined. Overall, the mixture of STREPTOMYCIN 17 + THIRAM 75 WP (2.0 g + 1.0 g) appeared to perform the best.

CONCLUSIONS: Under the conditions of this trial, treating bean seed with a fungicide or fungicide-bactericide combination significantly improved emergence compared to untreated seed.

Table 1. Percent emergence of CDC Expresso dry bean plants grown from naturally infested seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), alone or in various combinations, in a greenhouse trial at Brooks, Alberta, in 1996.

Treatment	Rate of product /kg seed	Emergence (%)*
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 g + 1.0 g	81.9 bc
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP**	1.0 g + 1.0 g	90.7 ab
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 g + 1.0 g	89.3 abc
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 g + 1.0 g	97.9 a
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 g + 1.0 g	93.6 ab
CHEM-COP 53 + THIRAM 75 WP	1.0 g + 1.0 g	84.0 c
THIRAM 75 WP	1.0 g	76.3 c
Untreated check	-	49.2 d
ANOVA $P \leq 0.05$		s
Coefficient of Variation (%)		15.4

* These values are the means of eight replications. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test ($P \leq 0.05$). ** Chemicals were applied by a commercial seed treatment plant.

PMR REPORT # 85 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. CDC Expresso
PESTS: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*; Common blight, *Xanthomonas campestris* pv. *phaseoli* (E.F. Smith) Dye

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca

TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT AND COMMON BLIGHT ON DRY EDIBLE BEANS: II. GREENHOUSE TRIALS WITH ARTIFICIALLY INFESTED SEED AT BROOKS, ALBERTA, IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP; equivalent to 50% streptomycin base), STREPTOMYCIN 17 (streptomycin sulfate 25.2% WP; equivalent to 17% streptomycin base), CAPTAN 400 (captan 37.4% SU), CHEM-COP 53 (tribasic copper sulfate 53% WP)

METHODS: CDC Expresso black bean seed was artificially infested with *Pseudomonas syringae* pv. *phaseolicola* (Psp) and *Xanthamonas campestris* pv. *phaseoli* (Xcp). Separate flasks of nutrient broth, two containing one isolate each of Psp and two containing one isolate each of Xcp, were incubated for two days at room temperature (ca. 22°C) on a rotary shaker. Afterwards, the two Psp cultures were poured into a large centrifuge tube and the two Xcp cultures into another. The tubes were centrifuged for 10 minutes at 10,000 rpm, the supernatant was decanted, and 150 mL of sterilized water was added to each tube containing bacterial sediment. The tubes were hand shaken to resuspend the bacteria, then the contents were combined in one flask (300 mL volume). This suspension, which contained ca. 10^9 colony forming units/mL, was sprayed onto 3.0 kg of beans and the seed was stirred to evenly distribute the inoculum over the surface. The inoculated seed was spread onto clean paper, allowed to air dry for two days, then divided into 500 g lots and each was treated with one rate of AGRICULTURAL STREPTOMYCIN + CAPTAN 400, three rates of STREPTOMYCIN 17 + CAPTAN 400, or one rate of CHEM-COP 53 + CAPTAN 400 (Table 1). The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 mL of water, and 13.0 mL of water was added to each portion of STREPTOMYCIN 17. Untreated, inoculated seed was used for the control. The seed treatment chemicals were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 500 g of seed was run through the treater to precoat the drum with the respective chemical in order to minimize adhesion losses during subsequent treatments. On May 28, the treated and untreated seeds were planted in steam-pasteurized potting soil. Each treatment consisted of eight, 15 cm diameter pots (replications) with 25 seeds/pot. The pots were placed in a greenhouse at Brooks using a randomized complete block design. Emergence counts were done June 7 and 10, and the data were tabulated, arcsin transformed and subjected to ANOVA.

RESULTS: Seedling emergence was poor overall, and only two of the treatments, AGRICULTURAL STREPTOMYCIN + CAPTAN 400 and CHEM-COP 53 + CAPTAN 400, resulted in significantly ($P \le 0.05$) better stands compared to the check.

CONCLUSIONS: Under the conditions of this trial, AGRICULTURAL STREPTOMYCIN and CHEM-COP 53 outperformed STREPTOMYCIN 17 as seed-applied bactericides.

Table 1. Percent emergence of CDC Expresso dry bean plants grown from artificially infested seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (CAPTAN 400), in various combinations, in a greenhouse trial at Brooks, Alberta, in 1996.

Treatment	Rate of product /kg seed	Emergence (%)*
AGRICULTURAL STREPTOMYCIN + CAPTAN 400	1.0 g + 1.5 mL	22.1 a
STREPTOMYCIN 17 + CAPTAN 400	1.0 g + 1.5 mL	17.0 ab
STREPTOMYCIN 17 + CAPTAN 400	2.0 g + 1.5 mL	14.7 ab
STREPTOMYCIN 17 + CAPTAN 400	3.0 g + 1.5 mL	10.2 b
CHEM-COP 53 + CAPTAN 400	1.0 g + 1.5 mL	38.6 a
Untreated check	-	8.6 b
ANOVA $P \le 0.05$		s
Coefficient of Variation (%)		32.9

* These values are the means of eight replications. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test ($P \le 0.05$).

PMR REPORT # 86 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. CDC Expresso
PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca
XUE A G
Agriculture and Agri-Food Canada, Agri-Food Diversification Research Centre
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5
Tel: (204) 822-4471; **Fax:** (204) 822-6841; **Email:** axue@em.agr.ca
WAHAB, M N J
Prairie Farm Rehabilitation Administration
Saskatchewan Irrigation Development Centre
P.O. Box 700, Outlook, Saskatchewan SOL 2NO
Tel: (306) 867-5406; **Fax:** (306) 867-9656; **Email:** pf22406@.em.agr.ca

TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT ON DRY EDIBLE BEANS: III. FIELD TRIALS IN ALBERTA, SASKATCHEWAN AND MANITOBA IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP; equivalent to 50% streptomycin base), STREPTOMYCIN 17 (streptomycin sulfate 25.2% WP; equivalent to 17% WP streptomycin base), THIRAM 75 WP (thiram 75% WP), CHEM-COP 53 (tribasic copper sulfate 53% WP)

METHODS: CDC Expresso black bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* was treated with one rate of AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP, three rates of STREPTOMYCIN 17 + THIRAM 75 WP, one rate of CHEM-COP 53 + THIRAM 75 WP, and one rate of THIRAM 75 WP alone. The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 mL of water, and 13.0 mL of water was added to each portion of STREPTOMYCIN 17. Each chemical treatment (Tables 1-6) was applied as a slurry to a separate, 1000 g lot of seed that had previously been commercially treated with THIRAM 75 WP. An additional 1000 g of seed was treated with tap water as a control. In the laboratory, seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 1000 g of seed was run through the treater to pre-coat the drum with the respective chemical in order to minimize adhesion losses during subsequent treatments. A sample of CDC Expresso bean seed with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP (1.0 g + 1.0 g) already applied was obtained from a commercial seed treatment plant in southern Alberta for comparison with laboratory-treated seed. The treated and untreated seed was planted with a hand-driven cone seeder in field plots at Morden (clay loam soil) on May 30, at Brooks (silt loam soil) on May 29, and at Outlook (sandy loam soil) on June 3. Each row of beans was bordered by two rows of barley planted no closer than 30 cm on either side to reduce the risk of inter-plot interference from splash-dispersed bacteria. Barley was also seeded between the replicate blocks. A randomized complete block design with four replications was used at each site.

Emergence was determined by counting all of the plants in each row at Brooks and Morden on June 17 and at Outlook on July 23. Halo blight incidence (% plants affected) and severity (proportion of leaf area affected) were rated on July 4 and July 29 at Brooks, on July 31, Aug. 14 and Sept. 3 at Morden, and on July 23 at Outlook. The visual assessment key for common bacterial blight of beans developed by James (1971) was used to estimate severity, i.e. 0 = no disease, 1 = slight (1-10% of leaf area blighted), 2 = moderate (11-25% blighted), 3 = severe (26-50% blighted), and 4 = very severe (>50% blighted). Severity ratings at Brooks and Outlook were done on 25 randomly selected leaflets per row, while 100 leaflets per row were used at Morden. The trials at Brooks, Morden and Outlook were harvested on Sept. 5, 18 and 23, respectively. At Brooks, all of the plants were dug and the roots were washed and visually rated for nodulation using a subjective scale, i.e. none, poor, good and very good, and the percentage of plants in each category was calculated. Percentage data were acrsin or square root transformed, as necessary, and subjected to ANOVA.

RESULTS: See Tables 1-6.
Brooks - Plant emergence from treated seed was better than from untreated seed, but there were few significant ($P \leq 0.05$) differences amongst chemical treatments (Table 1). Halo blight incidence and severity ratings were generally low on both examination dates and no significant differences occurred between treatments (Tables 1 & 2). Although most of the chemical treatments yielded more seed than the check, there were no significant differences (Table 2). The extent of nodulation on the root systems of plants grown from treated seed was, in most cases, slightly less than in the check, but these differences were not statistically significant (Table 3).
Outlook - All but two of the chemical treatments, STREPTOMYCIN 17 + THIRAM 75 WP (1.0 + 1.0 g) and THIRAM 75 WP alone, showed significantly ($P \leq 0.05$) better emergence than the check (Table 4). Disease incidence and severity ratings were too low to provide meaningful comparisons of the various treatments. No further measurements of disease incidence and severity were taken after July 23 because of heavy grasshopper damage to the foliage. Most of the chemical treatments outyielded the check, but these differences not statistically significant. The grasshopper infestation also had an adverse effect on yield where, once again, no significant differences were recorded.
Morden - Plants grown from seed commercially treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP emerged significantly ($P \leq 0.05$) better than any of the other chemical treatments (Table 5). It was also the only treatment that was statistically superior to the check. Disease incidence and ratings varied amongst treatments, but no significant differences were detected (Tables 5 & 6). Likewise, there were no significant differences in seed yield between any of the treatments under evaluation (Table 6).

CONCLUSIONS: Although chemically treated bean seed tended to produce significantly more emerged plants than untreated seed, this advantage was not reflected in lower levels of leaf blight, improved nodulation or higher seed yield under the conditions of these trials.

REFERENCE: James, W.C. 1971. A manual of assessment keys for plant diseases. Publ. 1458, Agric. Canada, Ottawa.

Table 1. Percent plant emergence and incidence of halo blight in CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product (g/kg seed)	(%) Emergence	Disease incidence (%)** July 4	July 29
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	65.3 ab	4.6	7.0
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP***	1.0 + 1.0	69.5 ab	2.4	4.9
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	61.5 b	6.2	7.7
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	65.7 ab	4.4	4.9
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 + 1.0	66.0 ab	2.4	0.3
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	70.7 a	0.9	1.1
THIRAM 75 WP	1.0	69.5 ab	2.9	0.3
Untreated check	-	52.2 c	1.2	8.7
ANOVA $P \leq 0.05$		s	ns	ns
Coefficient of Variation (%)		5.7	83.5	91.0

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

** These data were square root transformed before ANOVA and the detransformed means are presented here.

*** These chemicals were applied by a commercial seed treatment plant.

Table 2. Severity of halo blight on and yield of CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product (g/kg seed)	Disease severity (0-4) July 4	July 29	Yield (g/5 m row)
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	0.2	0.3	867.5
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP**	1.0 + 1.0	0.1	0.2	870.0
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	0.1	0.4	757.5
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	0.1	0.2	862.5
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 + 1.0	0.1	0.0	885.0
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	0.1	0.2	1020.0
THIRAM 75 WP	1.0	0.1	0.0	930.0
Untreated check	-	0.1	0.4	857.5
ANOVA $P \leq 0.05$		ns	ns	ns
Coefficient of Variation (%)		66.6	141.6	15.2

* These values are the means of four replications.

** These chemicals were applied by a commercial seed treatment plant.

Table 3. Extent of nodulation on roots of CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product (g/kg seed)	Nodulation (% plants per category)**			
		None	Poor	Good	VG
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	7.7	27.8	48.5	15.5
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP***	1.0 + 1.0	3.9	16.9	38.4	34.1
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	10.7	23.6	49.3	14.8
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	10.5	26.7	46.4	12.5
STREPTOMYCIN 17+ THIRAM 75 WP	3.0 + 1.0	10.1	24.9	47.2	16.5
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	14.8	20.4	48.0	14.7
THIRAM 75 WP	1.0	9.7	21.9	47.2	19.4
Untreated check	-	9.8	19.8	48.5	20.1
ANOVA P≤0.05		ns	ns	ns	ns
Coefficient of Variation (%)	31.4	19.5	11.8	33.1	

* These values are the means of four replications.

** These data were arcsin transformed before ANOVA and the detransformed means are presented here. VG = Very good nodulation.

*** These chemicals were applied by a commercial seed treatment plant.

Table 4. Percent plant emergence and incidence of halo blight in CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Outlook, Saskatchewan, in 1996.*

Treatment row)	Rate of product (g/kg seed)	Emergence** (%)	Yield m g/5m
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	60.3 a	169.5
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP***	1.0 + 1.0	61.9 a	210.5
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	54.0 ab	138.0
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	56.3 a	118.8
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 + 1.0	56.7 a	198.8
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	59.3 a	178.0
THIRAM 75 WP	1.0	53.0 ab	168.5
Untreated check	-	45.5 b	151.8
ANOVA P≤0.05		s	ns
Coefficient of Variation (%)		6.8	3.1

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P≤0.05).

** These data were arcsin transformed before ANOVA and the detransformed means are presented here.

*** These chemicals were applied by a commercial seed treatment plant.

Table 5. Percent plant emergence and incidence of halo blight in CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Morden, Manitoba, in 1996.*

Treatment	Rate of product (g/kg seed)	Emergence (%)	Disease incidence (%)** July 13	Aug.14	Sept.3
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	71.7 b	0.5	8.6	34.8
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP***	1.0 + 1.0	87.5 a	0.3	7.4	50.1
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	72.3 b	0.8	6.4	38.6
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	71.2 b	0.0	10.9	56.5
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 + 1.0	67.7 b	0.5	1.7	47.4
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	71.2 b	0.5	10.5	64.0
THIRAM 75 WP	1.0	72.0 b	0.5	6.2	51.7
Untreated check	-	63.3 b	0.8	8.6	37.1
ANOVA P≤0.05		s	ns	ns	ns
Coefficient of Variation (%)	7.8	162.3	38.2	18.9	

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's multiple Range Test (P≤0.05).

** These data were arcsin transformed before ANOVA and the detransformed means are presented here.

*** These chemicals were applied by a commercial seed treatment plant.

Table 6. Severity of halo blight on and yield of CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (THIRAM 75 WP), in various combinations, in a field trial at Morden, Manitoba, in 1996.*

Treatment	Rate of product (g/kg seed)	Disease severity (0-4) July 3	Aug.13	Sept.3	Yield (g/5 m row)
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP	1.0 + 1.0	0.5	1.0	2.4	584.5
AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP**	1.0 + 1.0	0.3	1.0	2.6	690.2
STREPTOMYCIN 17 + THIRAM 75 WP	1.0 + 1.0	0.5	1.0	2.5	573.6
STREPTOMYCIN 17 + THIRAM 75 WP	2.0 + 1.0	0.0	1.0	2.6	608.2
STREPTOMYCIN 17 + THIRAM 75 WP	3.0 + 1.0	0.3	0.7	2.5	640.6
CHEM-COP 53 + THIRAM 75 WP	1.0 + 1.0	0.3	1.0	2.8	683.6
THIRAM 75 WP	1.0	0.5	1.0	2.6	705.8
Untreated check	-	0.5	1.0	2.1	647.9
ANOVA P≤0.05		ns	ns	ns	ns
Coefficient of Variation (%)		144.1	18.2	11.8	19.3

* These values are the means of four replications.

** These chemicals were applied by a commercial seed treatment plant.

PMR REPORT # 087 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. CDC Expresso
PESTS: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*; Common blight, *Xanthomonas campestris* pv. *phaseoli* (E.F. Smith) Dye

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca

TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT AND COMMON BLIGHT ON DRY EDIBLE BEANS: IV. FIELD TRIALS AT BROOKS, ALBERTA, IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP; equivalent to 50% streptomycin base), STREPTOMYCIN 17 (streptomycin sulfate 25.2% WP; equivalent to 17% streptomycin base), CHEM-COP 53 (tribasic copper sulfate 53% WP) and CAPTAN 400 (captan 37.4% SU)

METHODS: CDC Expresso black bean seed was artificially infested with *Pseudomonas syringae* pv. *phaseolicola* (Psp) and *Xanthomonas campestris* pv. *phaseoli* (Xcp). Separate flasks of nutrient broth, two containing one isolate each of Psp and two containing one isolate each of Xcp, were incubated for two days at room temperature (ca. 22°C) on a rotary shaker. Afterwards, the two Psp cultures were poured into a large centrifuge tube and the two Xcp cultures into another. The tubes were centrifuged for 10 minutes at 10,000 rpm, the liquid portion was poured off, and 150 mL of sterilized distilled water was added to each tube containing bacterial sediment. The tubes were hand shaken to resuspend the bacteria, then the contents were combined in one flask (300 mL volume). This suspension, which contained ca. 10^9 colony-forming units/mL, was sprayed onto 3.0 kg of bean seed as it was being tumbled in a drum. The inoculated seed was spread onto clean paper to air dry for two days, then was divided into 500 g lots and treated with one rate of STREPTOMYCIN 17 + CAPTAN 400, three rates of STREPTOMYCIN 17 + CAPTAN 400, and one rate of CHEM-COP 53 + CAPTAN 400 (Tables 1-3). The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 mL of water, and 13.0 mL of water was added to each portion of STREPTOMYCIN 17, before they were combined with CAPTAN 400. No water was added to the mixture of CHEM-COP 53 + CAPTAN 400. Untreated, infested seed was retained as a control. The seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 500 g of seed was run through the treater to precoat the drum with the respective chemical in order to minimize adhesion losses during subsequent treatment. The treated and untreated seeds were planted with a hand-driven cone seeder in field plots at CDC South on May 29. Each row of beans was bordered by two rows of barley planted no closer than 30 cm on either side to reduce the risk of interplot interference from splash-dispersed bacteria. Barley was also seeded between replicate blocks. The treatments were arranged in a randomized complete block design with four replications.

Emergence was determined by counting all of the plants in each row on June 27. Blight incidence (% plants diseased) and severity (proportion of leaf area affected) were rated on two dates, July 4 and July 29. The visual assessment key for common bacterial blight of beans developed by James (1971) was used to estimate severity, i.e. 0 = no disease, 1 = slight (1-10% leaf area blighted), 2 = moderate (11-25% blighted), 3 = severe (26-50 % blighted), and 4 = very severe (>50% blighted). Severity ratings were done on 25 randomly selected leaves per row. The trial was harvested on September 5. All of the plants were dug and the roots were washed and visually rated for the degree of nodulation using a subjective scale, i.e. none, poor, good or very good, and the percentage of plants in each category was calculated. The above-ground portions of harvested plants were threshed and seed yields were determined. Percentage data were arcsin or square root transformed, where necessary, and subjected to ANOVA.

RESULTS: There were no significant ($P \leq 0.05$) differences in emergence or incidence of foliar bacterial blight between treatments (Table 1). Disease severity levels were very low and no significant differences were observed between treatments (Table 2). The same was true for seed yields. Nodulation was reasonably uniform and occurred at high levels across the trial; however, no significant differences were detected between treatments (Table 3).

CONCLUSIONS: Although the potential benefits of seed treatment on increasing plant emergence and seed yields and reducing disease incidence and severity were not clearly demonstrated in this trial, it is noteworthy that colonization of dry bean roots by *Rhizobium phaseoli* was not adversely affected by the chemical seed treatments used in this study.

REFERENCE: James, W.C. 1971. A manual of assessment keys for plant diseases. Publ. 1458, Agric. Canada, Ottawa.

Table 1. Percent emergence and incidence of halo blight and common blight on CDC Expresso dry beans grown from artificially infested seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (CAPTAN 400), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product /kg seed	Emergence (%)	Disease incidence (%)** July 4	Disease incidence (%)** July 29
AGRICULTURAL STREPTOMYCIN + CAPTAN 400	1.0 g + 1.5 mL	58.5	12.0	38.5
STREPTOMYCIN 17 + CAPTAN 400	1.0 g + 1.5 mL	62.2	9.1	24.3
STREPTOMYCIN 17 + CAPTAN 400	2.0 g + 1.5 mL	52.5	9.0	37.8
STREPTOMYCIN 17 + CAPTAN 400	3.0 g + 1.5 mL	56.2	5.3	22.7
CHEM-COP 53 + CAPTAN 400	1.0 g + 1.5 mL	57.2	8.3	31.5
Untreated check	-	53.0	2.6	29.2
ANOVA $P \leq 0.05$		ns	ns	ns
Coefficient of Variation (%)		6.2	41.9	22.7

* These values are the means of four replications.

** These data were arcsin transformed before ANOVA and the detransformed means are presented here.

Table 2. Severity of halo blight and common blight and seed yield of CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM COP 53) and one fungicide (CAPTAN 400), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product /kg seed	Disease severity (0-4)		Yield (g/5 m row)
		July 4	July 29	
AGRICULTURAL STREPTOMYCIN + CAPTAN 400	1.0 g + 1.5 mL	0.4	0.9	612.5
STREPTOMYCIN 17 + CAPTAN 400	1.0 g + 1.5 mL	0.4	0.7	680.0
STREPTOMYCIN 17 + CAPTAN 400	2.0 g + 1.5 mL	0.2	0.7	640.0
STREPTOMYCIN 17 + CAPTAN 400	3.0 g + 1.5 mL	0.2	0.7	660.0
CHEM-COP 53 + CAPTAN 400	1.0 g + 1.5 mL	0.5	0.7	665.0
Untreated check	-	0.1	0.6	720.0
ANOVA P≤0.05		ns	ns	ns
Coefficient of Variation (%)		71.9	22.4	22.9

* These values are the means of four replications.

Table 3. Extent of nodulation on roots of CDC Expresso dry beans grown from seed treated with three bactericides (AGRICULTURAL STREPTOMYCIN, STREPTOMYCIN 17 and CHEM-COP 53) and one fungicide (CAPTAN 400), in various combinations, in a field trial at Brooks, Alberta, in 1996.*

Treatment	Rate of product /kg seed	Nodulation (% plants per category)			
		None**	Poor**	Good	VG**
AGRICULTURAL STREPTOMYCIN + CAPTAN 400	1.0 g + 1.5 mL	5.9	15.8	63.8	13.6
STREPTOMYCIN 17 + CAPTAN 400	1.0 g + 1.5 mL	6.2	17.3	68.2	7.3
STREPTOMYCIN 17 + CAPTAN 400	2.0 g + 1.5 mL	4.8	18.9	61.6	11.4
STREPTOMYCIN 17 + CAPTAN 400	3.0 g + 1.5 mL	4.3	13.1	73.3	7.4
CHEM-COP 53 + CAPTAN 400	1.0 g + 1.5 mL	6.2	14.0	68.3	10.7
Untreated check	-	9.2	17.0	61.9	10.5
ANOVA P≤0.05		ns	ns	ns	ns
Coefficient of Variation (%)		34.4	17.8	10.4	24.2

* These values are the means of four replications.

** These data were square root transformed before ANOVA and the detransformed means are presented here. VG = very good nodulation.

PMR REPORT #88 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. CDC Expresso
PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca
VAN ROESSEL W & J
Speciality Seeds, P.O. Box 965, Bow Island, AB TOK OGO
Tel & Fax: (403) 545-6018; **Email:** none

TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT ON DRY EDIBLE BEANS: V. COMMERCIAL FIELD TRIALS IN SASKATCHEWAN IN 1996

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP; equivalent to 50% streptomycin base), THIRAM 75 WP (thiram 75% WP)

METHODS: Separate lots of CDC Expresso black bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* were treated with an AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP mixture and THIRAM 75 WP alone at a commercial seed treatment plant in southern Alberta. The two treated lots were bagged separately and sent to four farmers in west-central Saskatchewan, where they were planted in side-by-side strips in commercial fields. The objective of these trials was to collect data for the possible minor use registration of AGRICULTURAL STREPTOMYCIN for the control of bacterial blight diseases on dry edible beans. Two of the four fields were subsequently withdrawn from the study for technical reasons, leaving one each at Kindersley and Nokomis.

The 16 ha field at Kindersley was sown on May 31 with an air seeder using 86 kg/ha of seed. This seed was inoculated with *Rhizobium phaseoli* "So Fast" inoculant. The plant stand was poor and the soil dry when halo blight incidence (% plants infected) and severity (proportion of leaf area blighted, 0-4 scale) were rated on July 23. This rating procedure consisted of examining all of the plants in a 5 m section of row at each of ten sites in both the THIRAM 75 WP and STREPTOMYCIN + THIRAM 75 WP treatment strips. The ten sites were selected along either side of the line dividing the two strips down the length of each field. The visual assessment key for common bacterial blight of beans developed by James (1971) was used to estimate severity, i.e. 0 = no disease, 1 = slight (1-10% leaf area blighted), 2 = moderate (11-25% blighted), 3 = severe (26-50% blighted), and 4 = very severe (>50% blighted). Severity ratings were done on 25 randomly selected leaves per sampling site. All of the plants from each sampling site were carefully dug on September 3 and brought back to Brooks, where they were visually assessed for the extent of root nodulation (none, poor, good and very good rating categories). The above-ground potions were threshed and seed yields determined. Data were tabulated and subjected to ANOVA. Percentage values were arcsin or square root transformed, where necessary, prior to analysis.

The 6 ha field at Nokomis was planted on June 6 with a disk drill using 76 kg/ha of *Rhizobium*-inoculated seed. Halo blight incidence and severity were rated on July 23 using the same procedures as at Kindersley. Nodulation and seed yield data were also collected. Data were tabulated and analyzed as described previously for the Kindersley site.

RESULTS: The plant stand at Kindersley was poor and the incidence and severity of halo blight were low (Table 1); nevertheless, there was significantly

($P \leq 0.05$) less disease on plants in AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP treatment strip compared to the THIRAM 75 WP strip. There were no significant differences in seed yields (Table 1) or nodulation (Table 2) between the two treatments. The lack of nodules may have been due, in part, to the extremely hard, dry soil conditions, which made digging the roots difficult.

At Nokomis, the overall condition of the bean crop was fair and disease incidence and severity were low at the time of rating (Table 3). The AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP treatment had significantly less ($P \leq 0.05$) disease than the THIRAM 75 WP treatment. Seed yield in the STREPTOMYCIN + THIRAM 75 WP strip was higher than in the THIRAM 75 WP strip, but this difference was not statistically significant. The extent of nodulation throughout the field was generally high for both treatments (Table 4). Plants grown from seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP had significantly more poorly nodulated roots compared to THIRAM 75 WP alone, but the two treatments did not differ significantly in the percentage of plants that had good or very good nodulation.

CONCLUSIONS: Under the conditions of this trial, seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP produced bean crops with lower levels of halo blight and equivalent or higher seed yields than crops derived from seed treated with THIRAM 75 WP alone. Streptomycin seed treatment had little, if any, adverse effect on the development of root nodules.

REFERENCE: James, W.C. 1971. A manual of assessment keys for plant diseases. Publ. 1458, Agric. Canada, Ottawa.

Table 1. Incidence and severity of halo blight on and yield of CDC Expresso dry beans grown from seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP and THIRAM 75 WP alone in a commercial field trial at Kindersley, Saskatchewan, in 1996.*

Treatment	Rate of product (g/kg seed)	Disease incidence (%)**	Disease severity (0-4)	Yield (g/5 m)
THIRAM 75 WP	1.0	3.1b	0.1 b	51.0
AGRICULTURAL STREPTOMYCIN + THIRAM WP	1.0 + 1.0	0.4a	0.0 a	49.3
ANOVA $P \leq 0.05$		s	s	ns
Coefficient of Variation (%)		64.6	146.1	23.5

* The values in this table are the means of ten replications.

** These data were square root transformed before ANOVA and the detransformed means are presented here.

Table 2. Extent of nodule formation on roots of CDC Expresso dry beans grown from seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP and THIRAM 75 WP alone in a commercial field trial at Kindersley, SK in 1996.*

Treatment	Rate of product (g/kg seed)	Nodulation (% plants per category)** None	Poor	Good	VG
THIRAM 75 WP	1.0	99.3	0.4	0.0	0.0
AGRICULTURAL STREPTOMYCIN + THIRAM WP	1.0 + 1.0	98.9	0.2	0.4	0.4
ANOVA $P \leq 0.05$		ns	ns	-	-
Coefficient of Variation (%)		2.2	269.7	-	-

* The values in this table are the means of ten replications.

** These data were square root transformed before ANOVA and the detransformed means are present here. VG = very good nodulation.

Table 3. Incidence and severity of halo blight on and yield of CDC Expresso dry beans grown from seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM 75 WP and THIRAM 75 WP alone in a commercial field trial at Nokomis, Saskatchewan, in 1996.*

Treatment	Rate of product (g/kg seed)	Disease incidence (%)**	Disease severity (0-4)	Yield (g/5 m)
THIRAM 75 WP	1.0	6.3 b	0.2 b	89.0
AGRICULTURAL STREPTOMYCIN + THIRAM WP	1.0 + 1.0	1.5 a	0.1 a	107.4
ANOVA $P \leq 0.05$		s	s	ns
Coefficient of Variation (%)		51.8	90.7	33.7

* The values in this table are the means of ten replications.

** These data were square root transformed before ANOVA and the detransformed means are presented here.

Table 4. Extent of nodule formation on roots of CDC Expresso dry beans grown from seed treated with AGRICULTURAL STREPTOMYCIN + THIRAM WP and THIRAM 75 WP alone in a commercial field trial at Nokomis, Saskatchewan, in 1996.*

Treatment	Rate of product (g/kg seed)	Nodulation (% plants per category)** None	Poor	Good	VG
THIRAM 75 WP	1.0	32.7	29.7 a	27.6	6.3
AGRICULTURAL STREPTOMYCIN + THIRAM WP	1.0 + 1.0	24.8	42.9 b	22.8	5.1
ANOVA $P \leq 0.05$		ns	s	ns	ns
Coefficient of Variation (%)		29.8	12.1	24.4	41.3

* The values in this table are the means of ten replications.

** These data were arcsin transformed before ANOVA and the detransformed means are present here. VG = very good nodulation.

PMR REPORT # 89 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS
ICAR: 93000482

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. Othello
PEST: White mold, *Sclerotinia sclerotiorum* (Lib.) de Bary

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1326; **Email:** howardr@agric.gov.ab.ca
TEWARI J P
Faculty of Agriculture, Forestry and Home Economics
Department of Agricultural, Food and Nutritional Science
University of Alberta, Edmonton, Alberta T6G 2P5
Tel: (403)492-4554; **Fax:** (403) 492-4265; **Email:** jtewari@afns.ualberta.ca

TITLE: EFFICACY OF TWO COMMERCIAL FUNGICIDES AND SEVEN CALCIUM PRODUCTS FOR THE CONTROL OF WHITE MOLD ON DRY EDIBLE BEANS IN SOUTHERN ALBERTA IN 1996

MATERIALS: CALCIUM CARBONATE ($CaCO_3$; 40.04% Ca), CALCIUM ACETATE ($Ca(C_2H_3O_2)_2.H_2O$; 22.7% Ca), CALCIUM NITRATE ($Ca(NO_3)_2.H_2O$; 16.97% Ca), CALCIUM CHLORIDE ($CaCl_2.2H_2O$; 27.3% Ca), CALCIUM PHOSPHATE ($Ca(H_2PO_4)_2$; 15.9% Ca), CALCIUM SULPHATE ($CaSO_4.2H_2O$; 23.3% Ca), CALCIUM HYDROXIDE ($Ca(OH)_2$; 54.1% Ca), BENLATE (benomyl 50% WP), RONILAN DF (vinclozolin 50% WG)

METHODS: This trial was conducted in a commercial field of Othello pinto beans near Rolling Hills, Alberta, which was naturally infested with the white mold pathogen, *Sclerotinia sclerotiorum*. The plot rows were 16.5 m long and the row spacing was 60 cm. Each chemical treatment (Table 1) was applied to four, 10 m^2 subplots. A similar set of subplots was sprayed with tap water as an untreated check. The treatments were arranged in a randomized complete block design with four replications. The sprays were applied with a CO_2-propelled, hand-held sprayer equipped with one, Tee Jet 8001 nozzle. The spray was directed onto both sides of each row to ensure complete coverage. The equivalent of 375 L/ha of spray mixture was applied to each subplot using a boom pressure of 250 kPa. The beans were sprayed twice during the growing season, once on July 18 when the flower buds were just starting to open and the canopy had not yet closed over the rows, and again on August 8 when pods were forming and the canopy had covered between the rows. No white mold symptoms were evident at either spray date. Seven different calcium-containing products were applied at rates of 1.9 to 6.3 kg of product/ha. The fungicides RONILAN DF (1.0 kg/ha) and BENLATE (2.24 kg/ha) were also sprayed onto the plots. BENLATE was the commercial standard against which other products under test were compared.

On August 29 the total number of plants, as well as the number with white mold symptoms, were recorded along the entire length of each treatment row. These data were converted to % infected plants, arcsin transformed and subjected to ANOVA.

RESULTS: Disease levels within the plot were relatively low and variable. The subplots treated with CALCIUM HYDROXIDE, RONILAN DF and BENLATE had the lowest levels of disease, but they were not significantly ($P \leq 0.05$) different from the untreated check.

CONCLUSIONS: Under the low disease conditions of this experiment, five of the seven calcium products tested provided a level of white mold control equivalent to BENLATE, the standard fungicide.

Table 1. The incidence of white mold in Othello pinto dry beans sprayed with seven calcium products, RONILAN DF and BENLATE at Rolling Hills, Alberta, in 1996.*

Treatment	Rate of product (kg/ha)	% plants with white mold
CALCIUM CARBONATE	2.5	13.4 abcd
CALCIUM ACETATE	4.4	15.8 abc
CALCIUM CHLORIDE	3.8	13.4 abcd
CALCIUM PHOSPHATE	6.3	17.1 abc
CALCIUM SULPHATE	4.3	21.2 ab
CALCIUM HYDROXIDE	1.9	9.3 bcd
CALCIUM NITRATE	4.9	24.0 a
BENLATE	2.24	7.6 cd
RONILAN DF	1.0	4.6 d
Untreated check	-	14.1 abcd
ANOVA $P \leq 0.05$	-	s
Coefficient of Variation (%)		29.0

* Each value in this table is the mean of four replications. The raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test ($P \leq 0.05$).

PMR REPORT # 90 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS

ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cvs. Patriot and Carneval
PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.)

NAME AND AGENCY:

DENEKA B, TURNBULL G and HWANG S F
Alberta Research Council, Bag 4000, Vegreville, Alberta T9C 1T4
Tel: (403) 632-8228 **Fax:** (403) 632-8379 **E-mail:** barbden@aec.arc.ab.ca
CHANG K F and HOWARD R J
Crop Diversification Centre - South, SS#4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1334 **Fax:** (403) 362-1326 **E-mail:** changk@agric.gov.ab.ca

TITLE: **EFFECT OF TIMING AND FREQUENCY OF BRAVO SPRAYS ON MYCOSPHAERELLA BLIGHT OF FIELD PEA**

MATERIALS: BRAVO 500 F (chlorothalonil 500 g/L SU)

METHODS: Field plot experiments were conducted at two sites, Mundare and Westlock, Alberta in the spring of 1996. Both fields had severe mycosphaerella blight in 1995. Field pea cvs. Patriot and Carneval were planted 4 cm deep on May 15 and May 13 at Mundare and Westlock, respectively, with a grain drill at 20 g seeds/row. A peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows, with a 30 cm row spacing. Adjacent plots were separated by 0.2 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates.

Application of Bravo was made using a knapsack sprayer with a 8002 teejet nozzle at 250 kpa at three different growth stages: early flowering on July 13 and 22 (early spray), early podding on July 23 and 31 (mid-spray), and podding on August 9 and August 12 (late spray) at Mundare and Westlock, respectively. Bravo was sprayed either once, twice or three times depending on the spray schedule. There were ten treatments: early spray at two rates, mid-spray, early + mid sprays at two rates, mid + late sprays at two rates, early + mid + late sprays at two rates, and an untreated control. Bravo was applied at a recommended water volume (1000 L/ha) for each spray. Plots were assessed for symptoms of *Mycosphaerella pinodes* infection three weeks after the final application. The upper, middle and bottom portions of the plant were examined for foliage infection. Symptoms were visually estimated as the percent of foliage area infected using a 0 - 5 scale where 0 = no infection, 1 ≤10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100% of leaf area affected. The lesion on the lower stem was measured as well. At maturity, 4-metre sections of each plot were swathed and combined. Seeds were dried to 16% moisture at 40 °C and weighed.

RESULTS: Results are summarized in Tables 1 and 2. At both sites, all Bravo treatments significantly reduced the severity of mycosphaerella blight on the middle and lower leaves. The disease severity on the upper leaves was significantly reduced by all spray schedules except the single early sprays at Westlock, and by all multiple sprays at the lower rate at Mundare. Stem lesions were reduced by all Bravo treatments at Mundare and by the two triple spray treatments at Westlock. No significant differences occurred in seed yield for any of the Bravo treatments at either site, with the exception of the mid-spray treatment at Mundare.

CONCLUSIONS: Based on results obtained at two locations in Alberta, Bravo was effective in reducing the severity of mycosphaerella blight. In most cases, disease severity on leaves and stems with two or three sprays was significantly lower than on those treated with a single spray or the control. No differences in seed yield were observed between various spray schedules with Bravo, with the exception of the mid-spray treatment at Mundare.

Table 1. Effect of scheduled sprays of Bravo on severity of mycosphaerella blight and seed yield of field pea, Mundare, 1996[*].

Treatment	Rate (kg a.i. /ha)	Foliar Disease Severity[**]			Stem Lesion (cm)	Yield (g/plot)
		Upper	Middle	Lower		
Control	0	1.21 ab	2.74 a	4.19 a	12.2 a	1061 ab
Early Spray	3.1	1.13 bcd	2.31 b	3.81 b	10.3 b	1088 a
Early Spray	4.0	1.27 a	2.30 b	3.40 de	10.0 b	1136 a
Mid Spray	3.1	1.31 a	2.09 cd	3.64 bc	10.7 b	924 b
Early + Mid Sprays	2.0	1.01 d	1.80 ef	3.01 fg	9.0 c	1123 a
Early + Mid Sprays	3.1	1.11 bcd	1.68 f	3.01 fg	8.8 cd	1097 a
Mid + Late Sprays	2.0	1.06 cd	2.16 bc	3.54 cd	9.1 c	1109 a
Mid + Late Sprays	3.1	1.14 bc	1.91 de	3.23 ef	8.3 cd	1084 a
Early + Mid + Late Sprays	2.0	1.04 cd	1.84 ef	2.80 gh	8.1 d	1175 a
Early + Mid + Late Sprays	3.1	1.10 bcd	1.73 ef	2.67 h	6.8 e	1111 a
ANOVA $P \leq 0.05$		s	s	s	s	s

[*] Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

[**] Severity rating scale: 0 = clean, 1 ≤ 10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

Table 2. Effect of scheduled sprays of Bravo on severity of mycosphaerella blight and seed yield of field pea, Westlock, 1996[*].

Treatment	Rate (kg a.i. /ha)	Foliar Disease Severity[**]			Stem Lesion (cm)	Yield (g/plot)
		Upper	Middle	Lower		
Control	0	1.10 a	2.24 a	4.06 a	6.76 ab	1947
Early Spray	3.1	0.98 ab	1.55 b	3.39 bc	4.51 bc	2205
Early Spray	4.0	1.04 ab	1.40 bc	3.18 cd	5.01 abc	2213
Mid Spray	3.1	0.91 bc	1.48 bc	3.46 b	5.46 abc	2025
Early + Mid Sprays	2.0	0.59 d	0.99 d	2.06 f	4.24 bc	2135
Early + Mid Sprays	3.1	0.51 d	0.95 d	1.79 g	5.86 abc	2092
Mid + Late Sprays	2.0	0.83 c	1.30 c	2.68 e	7.18 a	1966
Mid + Late Sprays	3.1	0.84 c	1.50 b	2.95 d	4.86 abc	1994
Early + Mid + Late Sprays	2.0	0.64 d	1.09 d	1.71 g	3.56 c	2037
Early + Mid + Late Sprays	3.1	0.59 d	0.90 d	1.66 g	4.20 c	2131
ANOVA $P \leq 0.05$		s	s	s	s	ns

[*] Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

[**] Severity rating scale: 0 = clean, 1 ≤ 10%, 2 = 11-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of leaf area infected.

PMR REPORT # 91 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS

STUDY DATA BASE: 362-1241-9301

CROP: Field pea, cv Radley and Grande
PEST: Powdery mildew *Erysiphe pisi* Syd.

NAME AND AGENCY:
WARKENTIN T D, XUE A G, and MCANDREW D W
Agriculture and Agri-Food Canada, Morden Research Centre
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5
Tel: (204) 822-4471 **Fax:** (204) 822-6841

TITLE: EFFECT OF MANCOZEB AND MYCLOBUTANIL ON THE CONTROL OF POWDERY MILDEW OF FIELD PEA

MATERIALS: DITHANE (mancozeb 75%), NOVA 40W (myclobutanil 40%), RH-0611 (mancozeb 60% + myclobutanil 2%)

METHODS: Experiments were conducted at two sites three km apart (Morden-N and Morden-S) near Morden, Manitoba in 1996. Field pea (*Pisum sativum* L.) was planted in 4-row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split plot design with four replicates; the two cultivars Grande and Radley were the main plots, and fungicide treatments were subplots. Dates of seeding were 25 May at Morden-N and 3 June at Morden-S; harvest dates were 28 August at Morden-N and 10 September at Morden-S.

Natural infestations of powdery mildew occurred, i.e., plots were not inoculated. Fungicides rates were as follows: DITHANE 1500 g a.i./ha; NOVA 40W 56 g a.i./ha; RH-0611 (low) 900 g mancozeb/ha + 30 g myclobutanil/ha; RH-0611 (high) 1500 g mancozeb/ha + 50 g myclobutanil/ha. The fungicide treatments were applied either once or twice during the growing season. The initial application was made at the onset of symptoms which occurred on 25 July at Morden-N and on 23 July at Morden-S; second applications were made on 9 August at Morden-N and on 6 August at Morden-S. Fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held carbon dioxide pressurized field plot sprayer equipped with three TeeJet 8004SS nozzles. Plots were assessed for powdery mildew severity two weeks after the final application. Symptoms were visually estimated using a 0-9 scale, where 0=no infection and 9=all of the foliage area infected.

RESULTS: The effect of DITHANE, NOVA 40W, and RH-0611 on the control of powdery mildew on field pea at two locations in Manitoba in 1996 is summarized in Table 1. Powdery mildew severity was greater at Morden-S than at Morden-N. At Morden-N, all fungicides reduced powdery mildew severity. The most effective treatments were those containing myclobutanil. At Morden-S, double application of fungicides containing myclobutanil reduced powdery mildew severity. Fungicide treatments did not result in significant yield increases at Morden-N. At Morden-S, all fungicide treatments containing myclobutanil increased seed yield. Double applications of all treatments containing myclobutanil resulted in significantly greater yield than single applications. The double application of NOVA 40W resulted in a seed yield 164% of the untreated control.

CONCLUSIONS: DITHANE reduced powdery mildew severity under conditions of low disease pressure. NOVA 40W and RH-0611 were effective in reducing powdery mildew severity under conditions of high disease pressure. Under high disease pressure, field pea yield was increased by a single or double application of NOVA 40W and by a double application of RH-0611.

Table 1.
Effect of DITHANE, NOVA 40W, AND RH-0611 on the control of powdery mildew on field pea at two locations in Manitoba in 1996.

Treatment	No. of applications	Disease severity (0-9)		Yield (kg/ha)	
		Morden-N	Morden-S	Morden-N	Morden-S
DITHANE	1	4.5	5.9	3590	2160
NOVA 40W	1	1.9	5.8	3540	2400
RH-0611 (low)	1	2.6	5.8	3350	1840
RH-0611 (high)	1	2.7	5.8	3440	2150
DITHANE	2	4.2	6.0	3560	2010
NOVA 40W	2	1.6	2.0	3430	3230
RH-0611 (low)	2	2.3	2.9	3460	2980
RH-0611 (high)	2	1.6	2.3	3640	3110
CONTROL	0	5.9	6.2	3480	1970
C.V.		27.4	11.8	9.6	21.6
L.S.D. (0.05)		0.70	0.46	ns	440

PMR REPORT # 92 **SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 362-1241-9301

CROP: Field pea, cv Radley and AC Tamor
PEST: Mycosphaerella blight *Mycosphaerella pinodes* (Berk. & Blox.)

NAME AND AGENCY:
WARKENTIN T D, XUE A G, and MCANDREW D W
Agriculture and Agri-Food Canada, Morden Research Centre
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5
Tel: (204) 822-4471 **Fax**: (204) 822-6841

TITLE: EFFECT OF MANCOZEB AND MYCLOBUTANIL ON THE CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: DITHANE (mancozeb 75%), NOVA 40W (myclobutanil 40%), RH-0611 (mancozeb 60% + myclobutanil 2%)

METHODS: Experiments were conducted at two sites three km apart (Morden-N and Morden-S) near Morden, Manitoba in 1996. Field pea (*Pisum sativum* L.) was planted in 4-row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split plot design with four replicates; the two cultivars AC Tamor and Radley were the main plots, and fungicide treatments were subplots. Dates of seeding were 25 May at Morden-N and 3 June at Morden-S; harvest dates were 28 August at Morden-N and 10 September at Morden-S.

Plots were inoculated at the seedling (6-10 nodes) stage with pea straw infested with *Mycosphaerella* blight. Fungicides rates were as follows: DITHANE 1500 g a.i./ha; NOVA 40W 56 g a.i./ha; RH-0611 (low) 900 g mancozeb/ha + 30 g myclobutanil/ha; RH-0611 (high) 1500 g mancozeb/ha + 50 g myclobutanil/ha. The fungicide treatments were applied either once or twice during the growing season. The initial application was made at the onset of symptoms which occurred on 15 July at Morden-N and on 23 July at Morden-S; second applications were made on 30 July at Morden-N and on 6 August at Morden-S. Fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held carbon dioxide pressurized field plot sprayer equipped with three TeeJet 8004SS nozzles. Plots were assessed for *Mycosphaerella* blight symptoms two weeks after the final application. Symptoms were visually estimated using a 0-9 scale, where 0=no infection and 9=all of the foliage area infected.

RESULTS: The effect of DITHANE, NOVA 40W, and RH-0611 on the control of *Mycosphaerella* blight on field pea at two locations in Manitoba in 1996 is summarized in Table 1. *Mycosphaerella* blight severity was high at both locations. Fungicide treatments did not reduce *Mycosphaerella* blight severity at Morden-S. At Morden-N, DITHANE had a significant but small effect in reducing *Mycosphaerella* blight severity. Fungicide treatments did not result in significant yield increases at Morden-N. At Morden-S, all fungicide treatments except the single application of DITHANE increased seed yield. Double applications of all fungicides resulted in significantly greater yield than single applications.

CONCLUSIONS: DITHANE, NOVA 40W, and RH-0611 had little or no effect in reducing severity of *Mycosphaerella* blight. However, at one of two locations field pea yield was increased by single applications of NOVA 40W and RH-0611 and by double application of DITHANE.

Table 1. Effect of DITHANE, NOVA 40W, AND RH-0611 on the control of *Mycosphaerella* blight on field pea at two locations in Manitoba in 1996.

Treatment	No. of applications	Disease severity (0-9)		Yield (kg/ha)	
		Morden-N	Morden-S	Morden-N	Morden-S
DITHANE	1	6.4	6.3	2410	1900
NOVA 40W	1	6.8	6.5	2370	2110
RH-0611 (low)	1	6.6	6.5	2510	2020
RH-0611 (high)	1	6.7	6.4	2600	2080
DITHANE	2	6.2	6.4	2560	2120
NOVA 40W	2	6.6	6.4	2300	2370
RH-0611 (low)	2	6.7	6.3	2290	2440
RH-0611 (high)	2	6.6	6.3	2500	2520
CONTROL	0	6.8	6.4	2450	1790
C.V.		4.1	4.3	11.8	12.2
L.S.D. (0.05)		0.23	ns	ns	219

PMR REPORT # 93 SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS

CROP: Field pea, cv Radley and AC Tamor
PEST: Mycosphaerella blight *Mycosphaerella pinodes* (Berk. & Blox.)

NAME AND AGENCY:

WARKENTIN T D, XUE A G, MCANDREW D W and RASHID K Y
Agriculture and Agri-Food Canada, Morden Research Centre
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5
Tel: (204) 822-4471 **Fax**: (204) 822-6841 **Email**: TWARKENTIN@EM.AGR.CA

TITLE: EFFECT OF RATE AND TIMING OF APPLICATION OF CHLOROTHALONIL ON CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: BRAVO 500 (chlorothalonil 50%)

METHODS: The experiment was conducted at Morden, Manitoba in 1996. Field pea (*Pisum sativum* L.) was planted in 4-row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split-split plot design with four replicates; the two cultivars AC Tamor and Radley were the main plots, three BRAVO 500 rates (1.0, 1.5, and 2.0 kg a.i./ha) were subplots, and eight application frequency/timings (control, first flower (FF), mid-flower (MF), late flower (LF), FF+MF, FF+LF, MF+LF, FF+MF+LF) were the sub-sub plots. The entire experiment consisted of 192 plots. Date of seeding was 15 May; harvest date was 29 August.

Plots were inoculated at the seedling (6-10 nodes) stage with pea straw infested with *Mycosphaerella* blight. The initial application of BRAVO 500 was made at first flower which coincided with the onset of symptoms on 9 July; second application was made on 17 July; and third application was made on 25 July. Fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held carbon dioxide pressurized field plot sprayer equipped with three TeeJet 8004SS nozzles. Plots were assessed for *Mycosphaerella* blight symptoms two weeks after the final application. Symptoms were visually estimated using a 0-9 scale, where 0=no infection and 9=all of the foliage area infected.

RESULTS: A highly significant cultivar (main plot) effect occurred in this experiment for the *Mycosphaerella* blight severity rating (P=0.0001). AC Tamor was more susceptible, with mean rating 5.3, compared to Radley with mean rating 3.8. However, the cultivar effect was not significant for yield; AC Tamor and Radley had similar yield. AC Tamor has greater genetic yield potential, thus, yield was similar for the two cultivars despite more severe *Mycosphaerella* blight on AC Tamor.

A significant rate (sub-plot) effect occurred in this experiment for the *Mycosphaerella* blight severity rating (P=0.0014) and for yield (P=0.0453). Severity was less at the 1.5 and 2.0 kg a.i./ha BRAVO 500 rates than at the 1.0 kg a.i./ha rate. Correspondingly, yield was significantly greater at the 2.0 kg a.i./ha rate than at the 1.0 kg a.i./ha rate.

The effects of application frequency/timing (sub-sub plots) are summarized in Table 1. Since the interaction between cultivar and application frequency/timing was significant for both *Mycosphaerella* blight severity rating (P=0.0001) and yield (P=0.0001), data are presented for AC Tamor and Radley separately. Disease severity was reduced by single applications of BRAVO 500 on both cultivars. Multiple applications further reduced severity on AC Tamor, and to a lesser extent on Radley. Similarly, yield was increased by single applications of BRAVO 500 on both cultivars, with multiple applications further increasing yield of AC Tamor but not of Radley. A single application of BRAVO 500 applied at late flower resulted in a 67% yield increase for AC Tamor, while a single application at early flower resulted in a 19% increase for Radley. The most effective treatment was the triple application of BRAVO 500 which resulted in a 104% yield increase for AC Tamor and a 23% increase for Radley.

CONCLUSIONS: AC Tamor was more susceptible to *Mycosphaerella* blight than Radley. The 2.0 kg a.i./ha rate of BRAVO 500 was somewhat more effective than the 1.0 kg a.i./ha rate in reducing *Mycosphaerella* blight severity and increasing yield. Single applications of BRAVO 500 reduced disease severity and increased yield of both cultivars. AC Tamor, the more susceptible cultivar, was more responsive than Radley to multiple applications.

Table 1. Effect of timing of application of BRAVO 500 on the control of *Mycosphaerella* blight of field pea in Manitoba in 1996 (mean of the three rates of BRAVO 500 tested).

Application frequency/timing	Disease severity (0-9) AC Tamor	Radley	Yield (kg/ha) AC Tamor	Radley
CONTROL	6.8	5.8	2889	4169
FF*	5.9	4.0	4195	4958
MF	5.3	3.8	4655	4893
LF	5.5	3.4	4830	4874
FF+MF	5.1	3.5	4999	5092
FF+LF	5.0	3.3	5216	5028
MF+LF	4.7	3.3	5491	4964
FF+MF+LF	4.1	3.0	5908	5110
C.V.	7.0	8.4	6.1	6.3
L.S.D. (0.05)	0.30	0.26	236	252

* FF=first flower, MF=mid flower, LF=late flower

PMR REPORT # 94 **SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 362-1241-9402

CROP: Field pea, cv. Carneval
PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Bloxam) Vestergr.

NAME AND AGENCY:
[1]XUE A G, [2]MOONS B, [1]TUEY H, and [1]WOLFE I
[1]Agriculture and Agri-Food Canada, Morden Research Centre
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5
Tel: (204) 822-4471 **FAX:** (204) 822-6841
[2] Zeneca Agro, 3 - 75 Scurfield Blvd. Winnipeg, Manitoba R3Y 1P6
Tel: (204) 489-7860 **Fax:** (204)489-7923

TITLE: **EFFECT OF FUNGICIDE APPLICATIONS ON THE CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEAS - 1996**

MATERIALS: BRAVO 500 (Chlorothalonil 50%), ICIA5504 12.5%, ICIA5504 25%

METHODS: The field experiment was conducted at Morden in 1996. Field pea (*Pisum sativum* L.) cultivar Carneval was grown in 4-row plots, 3.0 m long with 30 cm row spacing. The experiment was arranged in a randomized complete block design with 4 replicates. Plots were seeded on 10 May at 75 seeds/m^2. All plots were inoculated with pea straw artificially infected with *Mycosphaerella pinodes* at 10 g straw/m^2 at 6-10 node growth stage. Treatments which consisted of fungicides and their rates were ICIA5504 at 125 g ai/ha, ICIA5504 250 g ai/ha, and chlorothalonil 1500 g ai /ha. Treated plots were sprayed either once or twice during the growing season, at early flowering and podding stages, on 3 and 19 July, respectively. The fungicides were applied in a water volume of 260 L/ha using a compressed air sprayer with 12.0 L capacity and equipped with a single cone nozzle. Disease severity was recorded on a scale of 0 (no disease) to 9 (all leaves of the plant severely blighted) on 8 August when plants were at pod-fill stage. Plants were harvested at maturity (27 August) and total seed yield per plot and 1000-seed weight adjusted to 13% seed moisture content were collected. Data were subjected to analysis of variance using the SAS program and treatment means were separated by the least significant difference test (LSD) at a probability level of 0.05.

RESULTS: All fungicide treatments were effective in reducing the severity of Mycosphaerella blight and increasing yield and quality in comparison to the unsprayed control (Table 1). Yield was increased by 28.6-51.2%, 15.6-24.3% and 15.5-36.3% from applications of ICIA5504 at 125 g ai/ha, ICIA5504 250 g ai/ha, and chlorothalonil 1500 g ai /ha, respectively. However, the yield improvements were not significantly different from the control, in agreement with the high variation in yield (CV = 44.1). ICIA5504 was more effective than chlorothalonil in both controlling the disease and increasing yield. The effects were greatest when ICIA5504 was applied twice at early flowering and podding stages at the rate of 125 g ai/ha.

CONCLUSIONS: Both ICIA5504 and chlorothalonil were effective in reducing the severity of Mycosphaerella blight and increasing seed yield and quality. ICIA5504 had a greater effect in reducing the disease and increasing the yield potential than that of chlorothalonil, which is currently considered the most effective fungicide for controlling Mycosphaerella blight of field pea in Canada.

ACKNOWLEDGMENT: The financial support of Zeneca Agro and the Manitoba Pulse

Growers Association Inc. is gratefully acknowledged.

Table 1. Effect of fungicide applications on control of Mycosphaerella blight of field pea in 1996

Fungicide	Application Rate (kg ai/ha)	Timing*	Disease severity (0-9)	Yield (kg/ha)	1000-seed weight (g)
ICIA5504	0.125	F	5.5 bcd**	2903 a	214.0 abc
ICIA5504	0.125	P	5.4 bcd	3321 a	216.9 abc
ICIA5504	0.125	F + P	4.9 d	3412 a	223.1 a
ICIA5504	0.250	F	5.5 bcd	2805 a	220.4 ab
ICIA5504	0.250	P	5.3 cd	2609 a	218.5 ab
ICIA5504	0.250	F + P	5.3 cd	2694 a	218.0 abc
Chlorothalonil	1.500	F	6.0 b	3077 a	211.0 bc
Chlorothalonil	1.500	P	5.6 bc	2779 a	212.3 abc
Chlorothalonil	1.500	F + P	5.8 bc	2607 a	214.4 abc
Control			6.9 a	2257 a	206.8 c

* F = Flowering and P = Podding.

** Values in the same column followed by the same letter are not significantly different at *P* = 0.05 (LSD).

PMR REPORT # 95 **SECTION H:** **DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Lettuce cv. Ithaca
PEST: Lettuce drop *Sclerotinia sclerotiorum* (Lib.) deBary and *Sclerotinia minor* Jagger

NAME AND AGENCY:
MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario LOG 1JO
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF LATE TRANSPLANTED LETTUCE, 1996

MATERIALS: DITHANE M-22 (maneb 80%), CALCIUM NITRATE (Ca 19%), LIME (dolomitic).

METHODS: Lettuce was seeded in plug trays (128 plugs/tray) on June 7 and the seedlings were transplanted on July 11, into naturally infested organic soil at the Muck Research Station. Rows were 42 cm apart and plant spacing at 30 cm. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 8 rows, 5 meters in length. Agricultural LIME was applied at 3 T/ha to the soil prior to transplanting. DITHANE M-22 at 2.25 kg/ha was used as a standard treatment for comparison with three concentrations (0.01, 0.1, 1.0% Ca) of CALCIUM NITRATE in solution as well as an untreated check. Foliar spray treatments were applied using a solo backpack sprayer at 60 p.s.i. using a flat fan nozzle in 500 L/ha of water on July 31, August 7, 14 and 21. The trial was harvested on August 28 and a sample of 25 heads per replicate was weighed. The number of heads infected with sclerotinia was assessed at harvest. Data were analyzed using the General Analysis of

Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: No significant (P=0.05) differences were found. All treatments had higher percent marketable heads than the check. The agricultural LIME at 3 T/ha had the lowest percentage of sclerotinia infection. Marketable weight did not differ significantly between treatments and check.

Table 1. Evaluation of DITHANE M-22, CALCIUM NITRATE, and LIME for control of lettuce sclerotinia at the Muck Research Station, Bradford, Ontario in 1996.

Treatment	Rate	Marketable heads (%)	Sclerotinia infection (%)	Marketable weight (kg)**
Check		48 a	2.55 a	31.45 a*
DITHANE M-22	2.25 kg/ha	60 a	3.10 a	28.96 a
CALCIUM NITRATE	0.01%	61 a	5.13 a	29.33 a
CALCIUM NITRATE	0.1%	59 a	1.85 a	29.45 a
CALCIUM NITRATE	1.0%	56 a	4.55 a	31.04 a
LIME	3 T/ha	57 a	0.70 a	31.35 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D. Test. ** 25 heads.

PMR REPORT # 96 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Lettuce cv. Ithaca
PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.) deBary and *Sclerotinia minor* Jagger

NAME AND AGENCY:
MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario LOG 1JO
Tel: (905) 775-3783 **Fax:** (905) 775-4546

TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF EARLY TRANSPLANTED LETTUCE, 1996

MATERIALS: DITHANE M-22 (maneb 80%), CALCIUM NITRATE (Ca 19%), LIME (dolomitic).

METHODS: Lettuce was seeded in plug trays (128 plugs/tray) on April 3 and the seedlings were transplanted on May 16, into naturally infested organic soil at the Muck Research Station. Rows were 42 cm apart and plants spaced 30 cm apart. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 8 rows, 5 meters in length. Agricultural LIME was applied at 3 T/ha to the soil prior to transplanting. DITHANE M-22 (2.25 kg/ha) was used as a standard treatment for comparison with three CALCIUM NITRATE solutions (0.01, 0.1 and 1.0% Ca), as well as an untreated check. Treatments were applied on June 19, 24 and July 3 using a solo backpack sprayer at 60 p.s.i. using a flat fan nozzle in 500 L of water per hectare. The trial was harvested on July 8 and samples of 25 heads per replicate were weighed. The number of heads infected with sclerotinia was assessed at harvest. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: The 1% CALCIUM NITRATE solution had the lowest percent of marketable heads and weight and the highest percent infection of Sclerotinia. Significant (P=0.05) differences were found between CALCIUM NITRATE (1%) and the check in percent marketable heads and percent infection. No significant differences were found between all other treatments. Significant differences were found between CALCIUM NITRATE (1%) and DITHANE M-22 in harvest yield. All other treatments were not significantly different. No noticeable signs of plant injury were observed on any treatments of CALCIUM NITRATE or LIME. CALCIUM NITRATE was not effective in the control of sclerotinia drop of lettuce under the conditions of this experiment.

Table 1. Evaluation of DITHANE M-22, CALCIUM NITRATE, and LIME for control of lettuce sclerotinia at the Muck Research Station, Bradford, Ontario in 1996.

Treatment	Amount	Marketable (%)	Sclerotinia infection (%)	Marketable (25 heads) weight (kg)
Check		74 a	2.25 a	29.29 ab
DITHANE M-22	2.25 kg/ha	69 ab	3.48 ab	31.04 a
CALCIUM NITRATE	0.01%	68 ab	4.13 ab	29.64 ab
CALCIUM NITRATE	0.1%	69 ab	3.68 ab	29.92 ab
CALCIUM NITRATE	1.0%	64 b	7.65 b	28.62 b
LIME	3 T/ha	70 ab	5.85 ab	30.43 ab

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D. Test.

PMR REPORT # 97 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
MCDONALD, M R, HOVIUS, M H Y and SCHUMACHER, B
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: **FIELD EVALUATION OF ONION BREEDING LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *Sclerotium cepivorum* BERK.**

MATERIALS: Onion breeding lines obtained from Asgrow Ltd.

METHODS: The trial was established in a commercial field (organic soil, pH 6.4, O.M. 60%) with a known history of white rot in the Holland Marsh. Onions were seeded, 35 to 48 seeds per m, using an Earth Way garden seeder. Onions were seeded in 2 rows 4cm apart with each group of 2 rows 42cm apart for a total of 8 rows across a bed in the field on June 21st. Each line was replicated four times (5m x 2 rows per replicate) and arranged in a randomized complete block design. Recommended procedures for weed and insect problems were followed. All onions were assessed for visible white rot infection in the field on October 15th, 1996. Data were analyzed using the General Analysis of

Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: Results are summarized in Table 1.

CONCLUSIONS. Significant (P=0.05) differences among lines in white rot incidence were found. Line XPH 15056 was significantly lower than the rest except XPH 15057 (Table 1). Line XPH 15058 had the highest white rot incidence and was significantly higher than the other lines except XPH 15055. All onions were seeded late and therefore, not all matured. The correlation between the percent mature bulbs and white rot incidence was not significant. Therefore, bulb maturity was not related to white rot incidence although disease incidence was low throughout the trial.

Table 1. White rot incidence in Asgrow onion lines, 1996.

Onion line	Incidence of white rot (%)
XPH 15058	8.195 a[*]
XPH 15055	5.366 ab
XPH 15059	4.625 b
XPH 15057	2.372 bc
XPH 15056	0.278 c

[*] Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 98 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
MCDONALD, M R, HOVIUS, M H Y and SCHUMACHER, B
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775 3783 **Fax**: (905) 775 4546

TITLE: FIELD EVALUATION OF CYPROCONAZOLE SEED TREATMENT AND CULTIVAR ON WHITE ROT INCIDENCE ON ONION BULBS.

MATERIALS: Pelleted and film coated Headliner seed treated with cyproconazole obtained from Swedesboro Seed Co., and 6 commercial cultivars Fortress, Bingo, Norstar, Bingo, Headliner and Joint Venture. All seed was treated with PROGRO.

METHODS: A trial was established in a commercial field (organic soil, pH 6.4, O.M. 60%) with a known history of white rot in the Holland Marsh. Onions were seeded using an Earth Way garden seeder giving 35 to 48 seeds per m for pelleted and 30 to 45 for filmed. Onions were seeded in 2 rows 4cm apart with each group of 2 rows 42cm apart for a total of 8 rows across a bed in the field on June 21st. The plot size for each onion breeding line was 5m x 2 rows. Each line was replicated four times and arranged in a randomized complete block design. Recommended procedures for weed and insect problems were followed. All onions were assessed for visible white rot infection in the field on October 15th (rep 1) and October 16th (rep 2, 3 and 4), 1996. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: Results are summarized in Table 1.

CONCLUSIONS: The commercial cultivar, Fortress had the lowest white rot incidence but was not significantly (P=0.05) lower from the other commercial cultivars (Joint Venture, Bingo, Norstar and Headliner) except for Prince (Table 1). The cyproconazole check from the pelleted seed (ie: no cyproconazole) had the highest white rot incidence but was not significantly different from the film coated seed with no cyproconazole and 1.5g a.i./kg, the pelleted seed with 2g a.i./kg of cyproconazole and the commercial cultivar, Prince (Table 1). The white rot incidence in all the film coated seed were not significantly different from each other except for the 2g a.i./kg treatment. All the onions were seeded late and therefore, not all matured. The correlation between the percent mature bulbs and white rot incidence was significant (P=0.0047 with r=-0.32). Therefore, as the number of mature onions increased the incidence of white rot decreased.

Table 1. White rot incidence on onion bulbs from Headliner onion seed treated with cyproconazole and untreated commercial seed of different cultivars, grown at one commercial site in 1996.

Cultivar/Source	Seed Coat	Cyproconazole*** (%)	White rot incidence (%)
HEADLINER/Swedesboro	pellet	0	39.917 a**
HEADLINER/Swedesboro	film	0	34.885 ab
HEADLINER/Swedesboro	pellet	2	32.190 a-c
PRINCE/Seedway	pellet	N/A*	30.486 a-d
HEADLINER/Swedesboro	film	1.5	26.358 a-e
HEADLINER/Swedesboro	pellet	1.5	23.127 b-e
HEADLINER/Petoseed	film	N/A	23.020 b-e
HEADLINER/Swedesboro	film	1	21.098 b-e
HEADLINER/Swedesboro	pellet	1	20.820 b-e
NORSTAR/Stokes	pellet	N/A	16.917 c-e
HEADLINER/Swedesboro	film	2	16.248 de
BINGO/Stokes	pellet	N/A	15.840 de
JOINT VENTURE/Stokes	pellet	N/A	11.693 e
FORTRESS/Asgrow	pelleted	N/A	10.884 e

* Commercial seed not treated with cyproconazole.

** Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. ***g a.i./kg of seed.

PMR REPORT # 99 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
MCDONALD, M R, HOVIUS, M H Y and SCHUMACHER, B
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775 3783 **Fax**: (905) 775 4546

TITLE: FIELD EVALUATION OF COMMERCIAL AND ONION BREEDING LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *Sclerotium cepivorum* BERK.

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Dr. R. Maxwell, Petoseed, and 4 commercial cultivars Fortress, Norstar, Paragon and Joint Venture.

METHODS: Trials were established in 3 commercial fields (organic soil, pH 6.4, O.M. 60%) with known histories of white rot in the Holland Marsh. Onions were seeded in 288 plug trays in the greenhouse on April 9 1996 and transplanted into the field on June 13th (Site 1), June 17th (Site 2) and June 26th (Site 3) in rows 42cm apart at 40 plants/m. The plot size for each onion line was 3m x 1 rows (Site 1 and 3) and 1.4m x 1 row (Site 2). Each line was replicated four times and arranged in a randomized complete block design. Recommended procedures for weed and insect problems were followed. All onions were assessed for visible white rot infection in the field on October 15th (Site 1) and October 16th (Site 2 and 3), 1996. Data were analyzed by General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: Results are summarized in Table 1 for site 1. There were no visible signs of white rot infection at site 2 and 3.

CONCLUSIONS: The onion lines could be divided into two main groups with different levels of white rot resistance. Higher levels of resistance were found in the onions from the University of Wisconsin (Table 1). Onions from Petoseed and the 4 commercial cultivars were less resistant. There were no significant ($P=0.05$) differences in white rot incidence among the Wisconsin lines. There was no significant correlation between the results from 1995 and 1996 although levels of resistance among lines fell into similar categories. All onions were transplanted late resulting in a shortened growing season. A large percentage of bulbs did not reach maturity. There was no visible signs of white rot infection at sites 2 and 3 which may be related to the infection cycle. The fungus attacks the onion when it begins to mature, sites 2 and 3 had the lowest number of mature onions. The correlation between the incidence of white rot and percent mature bulbs was significant, positive but low ($r=-0.218$), indicating that as the percent of mature bulbs increased the incidence of white rot decreased.

Table 1. White rot incidence in resistant onion lines grown at sites 1, 1995.

Onion line	Source	White rot incidence (%)
PSR 459494	Petoseed	41.189 a[*]
PSR 459694	Petoseed	36.250 ab
PSR 459294	Petoseed	33.642 a-c
PARAGON	Sunseeds	29.764 a-d
JOINT VENTURE	Stokes	26.705 b-e
FORTRESS	Asgrow	23.830 b-e
PSR 459394	Petoseed	22.650 c-f
NORSTAR	Stokes	21.430 c-g
PSR 499194	Petoseed	19.123 d-h
PSR 459094	Petoseed	17.449 d-i
W 454 B	Wisconsin	14.967 e-j
WR 458	Petoseed	13.027 f-k
PSR 459594	Petoseed	12.917 f-k
PSR 458994	Petoseed	11.651 f-k
(W 434 A X W 457) X W 458 C	Wisconsin	9.810 g-k
W 459 C	Wisconsin	8.691 g-k
(W 429 A X W 454) X W 455 B	Wisconsin	7.479 h-k
W 456 C	Wisconsin	5.821 i-k
W 458 C	Wisconsin	4.849 i-k
WR 459	Petoseed	2.965 jk
(W 440 A X W 458) X W 459 C	Wisconsin	2.816 jk
(W 434 A X W 455) X W 456 C	Wisconsin	1.760 k
W 455 B	Wisconsin	1.087 k
W 457 C	Wisconsin	0.781 k

[*] Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 100 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
MCDONALD, M R, SIRJUSINGH, C, HOVIUS, M H Y, and SCHUMACHER, B
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: EVALUATION OF COMMERCIAL ONION CULTIVARS FOR RESISTANCE TO WHITE ROT USING A SCALE INOCULATION TECHNIQUE.

MATERIALS: Onion bulbs harvested from Muck Research Station Main Cultivar Trial. Two isolates of *Sclerotium cepivorum* Berk, MCG-1, 1-9 and MCG-2, 3-6.

METHODS: Segments of onion scales of 35 cultivars were prepared for inoculation as follows. The outer dry scales were removed from mature bulbs. The bulbs were surface disinfested in a 10% commercial bleach solution for 5 minutes and rinsed twice in sterile distilled water. Onions air dried for 30 minutes had segments of approximately 5cm x 5cm cut from the 2nd, 3rd or 4th scales of each bulb (outer dry or thin green scales were discarded). Each scale's inner membrane was removed and the segment placed hollow side up on a sterilized perforated plastic tray (28cm x 50cm) and the underside labelled with a permanent marker. Two *Sclerotium cepivorum* isolates were tested based on two distinct mycelial compatibility groups (MCG-1, 1-9 and MCG-2, 3-6) present in the Holland Marsh (Earnshaw, 1994). The isolates were grown on potato dextrose agar one week prior to inoculation. Agar discs, 5mm in diameter, were cut from actively growing culture margins using a sterile cork borer and placed mycelial side down in the centre of each segment. Each mycelial line was replicated four times in a randomized complete block design. Each replication, arranged in one plastic tray was stacked in a plexiglass chamber (1.5m x 60 x 60cm) previously filled with water to 7.5cm to maintain high humidity. The chamber was covered with a black sheet for 5 days after which the diameter of the lesion formed on the scale undersides (convex side) was measured using a clear plastic ruler. A thermograph was placed beside the chamber and under the sheet to monitor the temperature. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V. 4.1.

RESULTS: Results are summarized in Table 1.

CONCLUSIONS: Onion cultivar had a significant (P=0.05) effect white rot growth. The cultivars could be divided into two main groups with moderate or high tolerance white rot growth. The Pearson correlation between the two isolates was significant, positive (r=0.6190) and a good indication of the similar reaction of the cultivars to the pathogen. Joint Venture (Aristogenes and Stokes) and VDH89573 were the most tolerant and Enrobee was most susceptible to both isolates. Fortress appeared to be more resistant to both isolates in compared to Norstar and Prince.

Table 1. White rot resistant variety plexiglass trial 1996.

Onion line	Seed Source	Diameter of Lesion (mm)	
		MCG-1, 1-9	MCG-2, 3-6
ENROBEE	Stokes	26.750 a[*]	22.625 a
CONDOR	American Takii	25.125 ab	19.250 b-d
BLITZ	Asgrow	24.500 a-c	18.375 b-e
DJANGO	Vanderhave	24.125 bc	16.625 e-i
SOLID GOLD	Aristogenes	22.750 b-d	18.375 b-e
RAINBOW	J.C. Canners	22.375 c-e	19.635 b
TRAPPS #7	Crookham	21.100 d-f	17.400 b-g
HAMLET	Asgrow	20.750 d-f	17.000 d-h
TORQUE	Crookham	20.000 e-g	12.875 b-e
NORSTAR	Stokes	20.000 e-g	19.500 bc
PRINCE	Seedway/Bejo	19.875 e-g	17.875 b-e
IMPACT	Harris Moran	19.750 fg	19.500 bc
ORIOLE	J.C. Canners	19.625 fg	16.250 e-i
LIBERTY	Aristogenes	19.625 fg	17.500 b-f
PROMISE	Crookham	19.250 fg	19.750 b
CORONA	Seedway/Bejo	18.875 fg	19.250 b-d
VOYAGER	Harris Moran	18.125 g	17.125 c-h
HUSTLER	Harris Moran	15.500 h	12.625 k-p
JOINT VENTURE	Aristogenes	15.250 hi	10.500 p
BENCHMARK	Asgrow	15.125 h-j	13.375 j-o
FORTRESS	Asgrow	14.750 h-k	12.125 m-p
TAMARA	Seedway/Bejo	14.750 h-k	13.500 j-o
TARMAGON	Stokes	14.500 h-k	15.250 f-j
VDH 8801	Vanderhave	14.375 h-k	14.500 i-m
ADVANCER	Harris Moran	13.875 h-k	15.000 g-k
GAZETTE	Petoseed	13.625 h-k	11.875 op
HEADLINER	Petoseed	13.625 h-k	12.500 l-p
JOINT VENTURE	Stokes	13.125 h-l	14.875 h-l
TURBO	Crookham	13.000 h-l	13.500 j-o
PARAGON	Sunseeds	12.875 i-l	13.250 j-o
TOPNOTCH	Crookham	12.625 j-l	12.000 n-p
DARIUS	Ferry Morse	12.375 kl	14.375 i-n
T-400	American Takii	12.250 kl	13.125 j-o
LEGACY	Sunseeds	12.250 kl	11.625 op
VDH 895 73	Vanderhave	10.750 l	15.125 f-j

[*] Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD test.

REFERENCES:

Earnshaw, D. 1994. Population diversity and virulence in *Sclerotium cepivorum*. M. Sc. Thesis. University of Guelph:120pp.

PMR REPORT # 101 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Onions
PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
MCDONALD, M R, SIRJUSINGH, C, HOVIUS, M H Y, and SCHUMACHER, B
Muck Research Station, HRIO, R.R. #1, Kettleby, Ontario L0G 1J0
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: EFFECT OF ARTIFICIAL GARLIC OIL PRODUCTS ON THE SURVIVAL OF WHITE ROT SCLEROTIA IN MUCK SOILS - POT TRIAL.

MATERIALS: Two germination stimulants (artificial garlic oil): DADS (diallyl disulphide 85.5%, diallyl sulphide 4.5%) and DPDS (n-propyl disulphide 88%, related compounds, 2%). Nylon sacs, 15cm plastic pots.

METHODS: On October 3rd, 1995, a 1.0m^2 area of white rot-free muck soil (organic soil, pH 6.4, O.M. 60%) was recovered from the Muck Research Station. Twelve 15cm plastic pots were filled with the muck soil (moisture content adjusted to 25%) to a depth of about 7cm. Four pots were treated with a suspension of DADS at a rate of 10L/ha in 500L of water (1mL/m^2 in 50mL water). A micropipette was used to apply 4.25mL of suspension into each pot. The pots were topped up with muck soil to a height of 15cm and the soil gently mixed with a hand trowel. The same procedure was repeated for the DPDS and water check treatments. Tap water was used for the control. The pots were placed in extra large plastic garbage bags and remained outdoors at the Muck Research Station for a period of 8 weeks after which they were transferred to the greenhouse bench (Nov 6, 1995). On Nov 28, the garbage bags were removed and nylon sacs containing 100 sclerotia (harvested from field infected onions) in 20g of white rot-free muck soil were buried in the pots (1 per pot) at a depth of 8 to 10cm. The pots were arranged in a randomized complete block design with 4 replications per treatment. The soil was kept moist during the experiment by watering when necessary. Temperature in the greenhouse ranged between 10 to 25 C. Following periods of 1, 2 and 3 months one sclerotia sac from each replicate was collected and brought to the lab for assessment. The sclerotia were recovered by wet sieving (10 mesh sieve stacked over a 60 mesh sieve), and the residue bleached in a solution of 1.25% NaOCl for up to 3 min. Thirty sclerotia from each sac were surface sterilized in 0.5% NaOCl for 1 min, plated out on PDA and incubated at 20 C. Germination was assessed after 5 days. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix v. 4.1.

RESULTS: Results are summarized in Table 1.

CONCLUSIONS: There were no significant (P=0.05) differences in the survival of sclerotia between the two garlic oil treatments and the untreated checks in the first month (Table 1). In the second and third months there were significant differences in the survival of sclerotia between the two garlic oil treatments and the untreated checks. Both the DADS and DPDS significantly reduced the survival of the white rot sclerotia in the second and third months with a significantly lower survival percentage in the DADS treatment than DPDS. The DADS more effectively reduced the viability of white rot sclerotia over the 3 month period.

Table 1. Effect of DADS and DPDS on the survival of white rot sclerotia in a greenhouse pot trial, comparison between treatments within each assessment month.

Treatment	Germination of sclerotia (%)		
	1st month	2nd month	3rd month
DADS	78.00 a*	15.00 a	18.35 a
DPDS	82.00 a	88.35 b	60.05 b
CHECK	100.00 a	99.18 c	99.18 c

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

PMR REPORT # 102 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Yellow cooking onions
PEST: Botrytis leaf blight, *Botrytis squamosa* Walker

NAME AND AGENCY:
MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario
LOG 1JO **Tel:** (905) 775-3783 **Fax:** (905) 775-4546

TITLE: **EVALUATION OF BOTRYTIS LEAF BLIGHT RESISTANCE IN ONION BREEDING LINES**

MATERIALS: Six onion cultivars were obtained from Thomas Walter, Cornell University, Ithaca, NY. One commercial onion cv. Voyager was also used. BRAVO 500 (chlorothalonil).

METHODS: Onions were seeded (36 seeds/m) into organic soil at the Muck Research Station on May 16. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 4 rows (42 cm apart), 5 meters in length. The commercial cultivar Voyager was treated with BRAVO 500 at 2.0 L/ha, an untreated control was also included. The fungicide was applied as a foliar spray with a solo backpack sprayer at 60 p.s.i. using a flat fan nozzle in 500 L/ha of water on August 1, 12, 21, and 30. The remaining six cultivars did not receive any fungicide sprays. Twenty-five plants per replicate were harvested on September 6 and 7 when the plants were near maturity. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percentage of green leaf area using the Manual of Assessment keys for Plant Disease by Clive James, key No. 1.6.1. The number of green leaves and dead leaves were also recorded. A harvest sample of 4.66 m was taken on September 25. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Botrytis leaf blight in 1996 first appeared approximately one month (mid June) earlier than in normal growing seasons. The disease pressure was intense for the first 6 weeks, then decreased due to better weather conditions. All six resistant lines had significantly lower percent disease than the unsprayed Voyager control. With the exception of 94-071-7, all the resistant lines had a significantly lower percent disease than the sprayed

Voyager control. Two resistant lines 94-TA-10 and 94-7A-11 were significantly different than all other treatments (exception 95-A-38) with the average number of green leaves per plant. However, cultivars 94-7A-10 and 94-7A-11 consisted of mostly double necked bulbs and therefore, had an advantage. There were significant (P=0.05) differences between resistant lines but not the Voyager controls in the number of dead leaves per plants. Resistance lines 94-079-IX, 94-169-TC and 94-D71-7 were significantly different in yield compared to the Voyager controls. There was no significant difference between the treated and untreated Voyager controls in yield. Some resistant lines showed good resistance to disease and good yields and therefore, have some commercial potential.

Table 1. A comparison of percent leaf area with disease, number of green leaves per plant and number of dead leaves per plant on yellow cooking onion breeding lines at the Muck Research Station, Bradford, Ontario in 1996.

Cultivar	Disease (%)	Average # green leaves/ plant	Average # dead leaves/ plant	Harvest yield (kg) (4.66 m)
Voyager (treated)	9.38 cd*	7.83 b	4.90 a	7.58 bc
Voyager (untreated)	10.00 d	7.79 b	5.42 ab	5.54 cd
94-079-IX	5.13 ab	7.82 b	4.70 a	13.53 a
94-169-TC	5.63 ab	8.44 b	4.80 a	11.62 a
94-TA-11	3.13 a	10.35 a	5.4 ab	2.03 d
94-D71-7	6.88 bc	7.39 b	4.76 a	9.61 ab
95-A-38	5.00 ab	8.67 ab	4.85 a	6.38 bc
94-TA-10	5.75 ab	10.40 a	5.89 b	3.59 cd

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D.Test.

PMR REPORT # 103 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Yellow cooking onions, cv. Fortress and Taurus
PEST: Onion Smut, *Urocystic cepulae* Frost

NAME AND AGENCY:
MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario LOG 1JO
Tel: (905) 775-3783 **Fax:** (905) 775-4546

TITLE: EVALUATION OF FUNGICIDE SEED, AND FURROW TREATMENTS FOR THE CONTROL OF ONION SMUT

MATERIALS: PRO GRO (carbathin 30%, thiram 50%), METHYL CELLULOSE, BAYTAN (triadimenol 32%), DITHANE DG (mancozeb 75%) DITHANE M-22 (maneb 80%).

METHODS: Raw onion seed from both cultivars was treated with several fungicides on May 6. The treatments consisted of: 1) PRO GRO applied at 25 g of product per kg of seed 2) PRO GRO applied at 25 g of product with 1% METHYL CELLULOSE per kg of seed 3) BAYTAN applied at 4.73 ml plus 5.27 ml of water per kg of seed 4) BAYTAN applied at 6.31 ml plus 3.69 ml of water per kg of seed. Additional treatments consisted of onion seed previously treated with

PRO GRO at 25 g of product plus 1% METHYL CELLULOSE per kg of seed with the following: A) BAYTAN applied at 4.73 ml plus 5.27 ml of water per kg of seed B) BAYTAN applied at 6.31 mL plus 3.69 mL of water per kg of seed C) DITHANE M-22 applied at 25.68 g plus 4.53 L of water per 100 m of row D) DITHANE DG applied at 25.68 g per 100 m of row. Raw onion seed was also treated with DITHANE M-22 at 25.68 g plus 4.53 L water per 100 m of row and DITHANE DG at 25.68 g per 100 m of row. An untreated check was also included. The trial was seeded on May 14 in naturally infested soil at the Muck Research Station. A randomized complete block arrangement with 4 blocks per replicate was used. Each replicate consisted of 2 rows (43 cm apart) cv. Fortress and 2 rows cv. Taurus, 5 m in length. The treatments were seeded using a V-belt push seeder delivering a random spacing and depth of 1.5 to 2.0 cm. DITHANE M-22 was applied with a solo backpack sprayer at 30 p.s.i. without the nozzle, over the seeded row. DITHANE DG was applied to the seed furrow by placing the fungicide on the V-belt with the seed. Germination counts were taken May 31, June 3, 5 and 10 from each of the three one metre sections of each cultivar in all of the treatments. When the onions reached 1 true leaf (June 18), a one metre section was harvested, washed and evaluated for incidence of smut. A second 1 m sample was taken on July 16. A final evaluation of smut was made at harvest on September 20 and October 3. Harvest weight was taken from the remaining 8 meters of onions on October 8. Data was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Tables 1, 2 and 3.

CONCLUSIONS: Significant (P=0.05) differences were found between treatments in both cultivars Fortress and Taurus. DITHANE DG (seed furrow) with PRO GRO + MC treatment on cultivar Fortress showed the lowest percentage of smut for all three harvest dates (Table 1). BAYTAN treatments were not significantly different or had significantly higher levels of smut then the untreated check. For the cultivar Taurus, DITHANE DG (seed furrow) with PRO GRO and MC treatment had the best results on the June 18 and July 16 harvest dates. BAYTAN treatments again were not significantly higher than the check for June 18 and July 16. The Fortress yields were significantly better for the DITHANE DG treatments than the untreated check and BAYTAN treatments (Table 3). The Taurus yields from the DITHANE DG treatments were significantly higher than all other treatments. BAYTAN treatments were not significantly higher in yield than the check. The yields from the two BAYTAN and PRO GRO and MC treatments were significantly higher than the untreated check, however, the BAYTAN and water treatments were not significantly different. The application of DITHANE DG as a seed furrow treatment helps to reduce the level of smut, and warrants further study. BAYTAN treatments appear to have some minor benefit.

Table 1. Evaluation of PRO GRO, BAYTAN, DITHANE M-22, and DITHANE DG on onion smut on cv. Fortress at the Muck Research Station, Bradford, Ontario in 1996.

Treatments	Amount	Incidence of Smut (%)		
		June 18	July 16	Sept. 20
Check		72.9 c*	31.4 cd	17.7 b
PRO GRO	25 g/kg	73.8 c	15.6 ab	19.6 ab
PRO GRO + METHYL CELLULOSE	25 g/kg	71.8 c	28.2 bc	16.7 b
BAYTAN + water	4.73 ml + 5.27 ml	78.1 c	46.8 e	29.9 ab
BAYTAN + water	6.31 ml + 3.69 ml	64.3 bc	42.4 de	20.3 ab
BAYTAN + water + PRO GRO + METHYL CELLULOSE	4.73 ml + 5.27 ml 25 g/kg	45.1 c	26.7 bc	39.2 a
BAYTAN + water + PRO GRO + METHYL CELLULOSE	6.31 ml + 3.69 ml 25 g/kg	71.4 c	31.7 cd	13.7 b
DITHANE M-22 (drench) + 43.5 L 100 m/row	25.68 g	76.6 c	53.1 e	18.0 b
DITHANE M-22 (drench) + 43.5 L 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	52.1 ab	23.7 abc	14.6 b
DITHANE DG (seed furrow) 100 m/row	25.68 g	62.1 abc	11.0 a	21.0 ab
DITHANE DG (seed furrow) 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	44.7 a	10.5 a	10.7 b

Table 2. Evaluation of PRO GRO, BAYTAN, DITHANE M-22, and DITHANE DG on onion smut on cv. Taurus at the Muck Research Station, Bradford, Ontario in 1996.

Treatments	Amount	Incidence of Smut (%)		
		June 18	July 16	Oct. 3
Check		72.0 d*	30.1 bcd	41.2 c
PRO GRO	25 g/kg	54.3 abc	34.1 cde	19.4 ab
PRO GRO + METHYL CELLULOSE	25 g/kg	47.6 abc	20.2 ab	15.7 ab
BAYTAN + water	4.73 ml + 5.27 ml	67.8 cd	37.0 cde	30.7 bc
BAYTAN + water	6.31 ml + 3.69 ml	56.7 a-d	39.8de	13.4 ab
BAYTAN + water + PRO GRO + METHYL CELLULOSE	4.73 ml + 5.27 ml 25 g/kg	76.4 d	30.7 bcd	9.1 a
BAYTAN + water + PRO GRO + METHYL CELLULOSE	6.31 ml + 3.69 ml 25 g/kg	67.2 cd	24.9 bcd	12.0 ab
DITHANE M-22 (drench) + 43.5 L 100 m/row	25.68 g	61.3 bcd	49.0 e	9.6 a
DITHANE M-22 (drench) + 43.5 L 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	39.7 ab	21.4 ab	13.3 ab
DITHANE DG (seedfurrow) 100 m/row	25.68 g	39.3 ab	15.1 a	26.2 abc
DITHANE DG (seed furrow) 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	37.6 a	13.4 a	10.9 ab

Table 3. Yield data in kg from 1 m of row for both Fortress and Taurus at the Muck Research Station, Bradford, Ontario in 1996.

Treatments	Amount	Yield (kg/m)	
		Fortress	Taurus
Check		2.4 cde*	1.6 e
PRO GRO	25 g/kg	2.7 bcd	2.1 cd
PRO GRO + METHYL CELLULOSE	25 g/kg	2.9 bc	2.2 bc
BAYTAN + water	4.73 ml + 5.27 ml	2.2 de	1.9 cde
BAYTAN + water	6.31 ml + 3.69 ml	1.8 e	1.8 de
BAYTAN + water + PRO GRO + METHYL CELLULOSE	4.73 ml + 5.27 ml 25 g/kg	2.2 de	2.2 bc
BAYTAN + water + PRO GRO + METHYL CELLULOSE	6.31 ml + 3.69 ml 25 g/kg	2.6 cd	2.2 bc
DITHANE M-22 (drench) + 43.5 L 100 m/row	25.68 g	2.2 de	1.2 f
DITHANE M-22 (drench) + 43.5 L 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	2.3 cde	2.4 b
DITHANE DG (seed furrow) 100 m/row	25.68 g	3.6 a	2.8 a
DITHANE DG (seed furrow) 100 m/row + PRO GRO + METHYL CELLULOSE	25.68 g 25 g/kg	3.1 ab	3.1 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05 Fisher's Protected L.S.D. Test.

PMR REPORT # 104 **SECTION H: DISEASES OF VEGETABLE AND SPECIAL CROPS**
ICAR #: 206003

CROP: Yellow cooking onions cv. Benchmark
PEST: Botrytis leaf blight, *Botrytis squamosa* Walker

NAME AND AGENCY:

MCDONALD M R, JANSE S and VANDER KOOI K
Muck Research Station, H.R.I.O., R.R. # 1 Kettleby, Ontario LOG 1J0
Tel: (905) 775-3783 **Fax**: (905) 775-4546

TITLE: EFFICACY OF FUNGICIDE PENNCOZEB 75 DF FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT OF ONIONS, 1996

MATERIALS: PENNCOZEB 75 DF (mancozeb 75%)

METHODS: Onions were seeded (36 seeds/m) into organic soil at the Muck Research Station on May 16. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 4 rows (42 cm apart), 5 meters in length. PENNCOZEB 75 DF was applied singly at 2.25 kg/ha. An untreated check was also included. PENNCOZEB DF was applied on August 1, 12, 21, and 30 as a foliar spray with a solo backpack sprayer at 60 p.s.i. using a flat fan nozzle in 500 L/ha of water. Twenty-five plants per replicate were harvested on September 6 when the plants were near maturity. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percentage of green leaf area using the Manual of Assessment keys for Plant Disease by Clive James, Key No. 1.6.1. The number of green leaves and dead leaves were also recorded. A harvest yield of 4.66 m was taken on September 25. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: No significant (P=0.05) differences were found between the fungicide treatment and the untreated check. PENNCOZEB 75DF did not affect the average number of dead or green leaves per plant nor the percentage of green leaf tissue compared to the untreated control.

Table 1. Evaluation of PENNCOZEB 75 DF for the control of Botrytis leaf blight on the three oldest green leaves at the Muck Research Station, Bradford, Ontario in 1996.

Treatment	Green tissue (%)	Average # dead leaves /plant	Average # green leaves /plant	Harvest yield (kg) (4.33 m)
PENNCOZEB 75 DF	88.7 a*	4.52 a	7.64 a	8.74 a
Control	90.0 a	4.44 a	7.24 a	9.40 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected L.S.D. Test.

PMR REPORT # 105 **SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR NUMBER: 61006536

CROP: Field Tomatoes cv. Heinz 9478
PEST: Early Blight, *Alternaria solani,* Sorauer; Septoria Leaf Spot, *Septoria lycopersici,* Speg.

NAME AND AGENCY:
PITBLADO, R.E.
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: **CANDIDATE FUNGICIDES FOR THE CONTROL OF TOMATO FOLIAR FUNGAL DISEASES**

MATERIALS: BRAVO 500 (chlorothalonil), DITHANE 75DG (mancozeb), PENNCOZEB 75DF (mancozeb), ZIRAM 76DF (ziram), POLYRAM 80DF (metiram), MAESTRO 75DF (captan), ICIA5504 80WG (experimental), TOPAS 250EC(propiconazole)

METHODS: Tomatoes were transplanted at Ridgetown in single twin-row plots in a Fox sandy loam soil type, 7m in length with rows spaced 1.65m apart, replicated four times in a randomized complete block design. Seedlings were transplanted using a commercial transplanter on May 28, 1996. Foliar applications of fungicides were applied using a specialized small plot research CO_2 sprayer with a single Tee Jet nozzle hand-held boom regulated at 50 psi, applying 200 L/ha of spray mixture on June 21, July 5, 16, 25, Aug.

6,14, 26 and Sept. 5. In treatment #7, ZIRAM 76DF was applied for the first 4 applications followed by BRAVO 500 for the remaining 4 applications in August and early Sept. Foliar disease assessments, rated across each plot using a visual rating scale of 0-10: 0, no control, foliage severely damaged while 10 being complete control, were taken on Aug. 17, 25, Sept. 1, 14, and 27. Results were analysed using the Duncan's multiple Range Test (P•0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: Tomato plants were defoliated by a severe hail storm on July 7. For that reason yields and fruit anthracnose counts were not taken. Plants did recover remarkably well after the storm providing abundant foliage suitable to assess foliar disease control. ICIA5504 80WG and BRAVO 500 were the most outstanding materials tested providing equal levels of control of predominantly early blight. PENNCOZEB 75DF gave the next level of control providing more persistent foliar disease control than did the similar mancozeb based product in the formulation of DITHANE 75DG. The higher rate of DITHANE 75DG was needed to sustain disease control as disease control was assessed further past the last spray application. MAESTRO 75DF and POLYRAM 80DF were moderately effective followed by TOPAS 250EC. ZIRAM 76DF was ineffective in controlling foliar diseases in tomatoes late in the season when applied throughout the entire spray season. The change to BRAVO 500 for the last 4 applications in August and early Sept., improved the control, however not to the level of where BRAVO 500 was applied singly from the beginning of the trial.

Table 1. Foliar damage results.

	Rate	Foliar Damage Ratings (0-10)*				
Treatments	product/ha	Aug. 17	Aug. 25	Sept. 1	Sept. 14	Sept. 27
BRAVO 500	2.8L	9.3ab**	8.5a	8.6a	8.8a	7.3ab
BRAVO 500	3.2L	8.5ab	8.6a	8.0ab	8.3ab	7.3ab
DITHANE 75DG	1.1kg	7.8bc	8.3ab	7.0ab	5.5gh	2.5e
DITHANE 75DG	3.25kg	8.8ab	8.3ab	7.4ab	7.1de	4.5d
PENNCOZEB 75DF	3.25kg	9.3ab	8.3ab	8.5ab	7.5bcd	7.3ab
ZIRAM 76DF	4.5kg	8.5ab	8.1ab	7.0ab	4.8h	2.5e
ZIRAM 76DF; BRAVO 500	4.5kg 2.8L	8.8ab	7.0b	6.8ab	6.3fg	6.1bc
POLYRAM 80DF	3.25kg	9.3ab	8.0ab	7.5ab	7.0def	5.0cd
MAESTRO 75DF	3.0kg	9.3ab	7.8ab	7.3ab	7.3cde	5.0cd
MAESTRO 75DF	4.5kg	8.0bc	7.8ab	8.0ab	6.5ef	6.0bcd
ICIA5504 80WG	0.063kg	8.8ab	8.3ab	8.3ab	8.0abc	8.8a
ICIA5504 80WG	0.125kg	9.8a	8.5a	7.4ab	8.4a	8.8a
TOPAS 250EC	0.5L	9.0ab	7.3ab	6.6b	6.8ef	6.5bc
Control		6.8c	5.8c	3.5c	2.8i	1.0e

* Foliar Damage Ratings (0-10); 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not significantly differ (P•0.05, Duncan's multiple range test).

PMR REPORT # 106 **SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 61006536

CROP: Field Tomatoes cv. Heinz 9478
PEST: Early Blight, *Alternaria solani*, Sorauer; Septoria Leaf Spot, *Septoria lycopersici*, Speg.

NAME AND AGENCY:
PITBLADO, R.E.
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax:** (519) 674-1600

TITLE: **CONTROL OF BACTERIAL DISEASES IN FIELD TOMATOES**

MATERIALS: KOCIDE 101 (copper hydroxide), DITHANE 75DG (mancozeb), LONLIFE 20% (citrex liquid + organic acids + deionized water), CALCIUM CHLORIDE (fertilizer), DACOBRE DG (chlorothalonil + copper), CATALYST (experimental)

METHODS: Tomatoes were transplanted at Ridgetown in single twin-row plots in a Fox sandy loam soil type, 7m in length with rows spaced 1.65m apart, replicated four times in a randomized complete block design. Seedlings were transplanted using a commercial transplanter on May 28, 1996. Foliar applications of fungicides were applied using a specialized small plot research CO_2 sprayer with a single Tee Jet nozzle hand-held boom regulated at 50 psi, applying 200 L/ha of spray mixture on June 25, July 15, 25, Aug. 6, 14, 26 and Sept. 5. Foliar disease assessments, rated across each plot using a visual rating scale of 0-10: 0, no control, foliage severely damaged while 10 being complete control, were made on Aug. 25, Sept. 1, 14 and 27. Results were analyzed using the Duncan's multiple range test (P•0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: Tomato plants were defoliated by a severe hail storm on July 7. For that reason yields and fruit anthracnose counts were not taken. Plants did recover remarkably well after the storm providing abundant late season foliage suitable for foliar plant disease control assessments. Bacterial disease pressures were extremely light thus the treatments were evaluated for control of foliar fungal diseases. The most effective materials used were DACOBRE DG and the combination of DITHANE 75DG added to KOCIDE 101. KOCIDE 101 when applied alone provided reasonable foliar fungal disease control up to Sept. 1 in this trial, however, control based on visual disease symptoms lessened thereafter. The addition of the CATALYST did not improve the effectiveness of KOCIDE 101. LONLIFE 20% and CALCIUM CHLORIDE were ineffective in controlling foliar fungal diseases in tomatoes.

Table 1. Foliar damage results.

Treatments	Rate product/ha	Foliar Damage Ratings (0-10)* Aug. 25	Sept. 1	Sept. 14	Sept. 27
KOCIDE 101	2.25 kg	9.3ab**	8.8a	8.1b	7.3b
KOCIDE 101 +	2.25 kg				
DITHANE 75DG	2.25 kg	9.3ab	9.0a	9.1a	8.4a
LONLIFE 20%	1.5 L	8.3bc	4.0b	3.8c	2.8c
CALCIUM CHLORIDE	1.12 kg	8.1c	3.3b	3.5c	2.5c
DACOBRE DG	6.75 kg	9.5a	9.1a	9.3a	9.0a
KOCIDE 101 +	2.25 kg				
CATALYST	1.0 L	9.4a	9.0a	8.3b	7.1b
Control		8.3bc	3.8b	4.0c	3.3c

* Foliar Damage Ratings (0-10); 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not significantly differ (P•0.05, Duncan's multiple range test).

PMR REPORT # 107 **SECTION H: DISEASES OF VEGETABLES AND SPECIAL CROPS**
ICAR #: 61006536

CROP: Field Tomatoes cv. Heinz 9478
PEST: Early Blight, *Alternaria solani*, Sorauer; Septoria Leaf Spot, *Septoria lycopersici*, Speg.

NAME AND AGENCY:
PITBLADO, R.E.
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1605 **Fax**: (519) 674-1600

TITLE: IMPROVING THE EFFECTIVENESS OF COPPER FOR THE CONTROL OF BACTERIAL DISEASES IN TOMATOES

MATERIALS: KOCIDE 101 (copper hydroxide), DITHANE 75DG (mancozeb), BRAVO 500 (chlorothalonil), CATALYST (experimental), COMPANION (surfactant)

METHODS: Tomatoes were transplanted at Ridgetown in single twin-row plots in a Fox sand loam soil type, 7m in length with rows spaced 1.65m apart, replicated four times in a randomized complete block design. Seedlings were transplanted using a commercial transplanter on May 28, 1996. Foliar applications of fungicides were applied using a specialized small plot research CO_2 sprayer with a single Tee Jet nozzle hand-held boom regulated at 50 psi, applying 200 L/ha of spray mixture on June 25, July 15, 25, Aug. 6 15, 26 and Sept. 5. Foliar disease assessments, rated across each plot using a visual rating scale of 0-10: 0, no control, foliage severely damaged while 10 being complete control, were made on Aug. 25, Sept. 1, 14 and 28. Results were analyzed using the Duncan's multiple range test (P•0.05).

RESULTS: Results are presented in the tables below.

CONCLUSIONS: Tomato plants were defoliated by a severe hail storm on July 7. For that reason yields and fruit anthracnose counts were not taken. Plants did recover remarkabl well after the storm providing abundant late season foliage suitable for foliar plant disease control assessments. Bacterial disease pressures were extremely light thus the treatments were evaluated for control of foliar fungal diseases. The addition of BRAVO 500 significantly improved the fungal disease control when added to KOCIDE 101. The level of disease control was considerably higher with the BRAVO 500 + KOCIDE 101 combination than with the combination of KOCIDE 101 with DITHANE 75DG. KOCIDE 101 when applied alone was ineffective in controlling late season foliar fungal diseases in tomatoes. The addition of the higher rate of the CATALYST with KOCIDE 101 slightly increased the level of disease control, however, disease control was reduced when the surfactant COMPANION was added to the KOCIDE 101 + CATALYST combination. The CATALYST itself did not provide any level of fungal disease control.

Table 1. Foliar damage results.

	Rate	Foliar Damage Ratings (0-10)*			
Treatments	product/ha	Aug. 25	Sept. 1	Sept. 14	Sept. 28
KOCIDE 101	2.25 kg	8.6abc**	8.5ab	7.3bc	4.0bcd
KOCIDE 101 +	2.25 kg				
DITHANE 75DG	2.25 kg	9.0ab	8.0ab	7.5b	6.0b
KOCIDE 101 +	2.25 kg				
BRAVO 500	2.8 L	9.1ab	9.3a	8.8a	8.1a
KOCIDE 101 +	2.25 kg				
CATALYST	1.0 L	9.0ab	7.8b	5.8d	3.0de
KOCIDE 101 +	2.25 kg				
CATALYST	2.0 L	9.2ab	8.0ab	7.5b	5.4bc
KOCIDE 101 +	2.25 KG				
CATALYST +	1.0 L				
COMPANION	0.1% v/v	8.1bc	6.1c	5.8d	3.8cd
KOCIDE 101 +	2.25 kg				
CATALYST +	2 L				
COMPANION	0.1% v/v	9.4a	7.8b	6.5cd	2.3de
CATALYST	1.0 L	6.8d	3.0d	2.3e	1.0e
CATALYST	2.0 L	6.4d	3.0d	2.0e	1.0e
Control		7.8c	3.8d	2.0e	1.0e

* Foliar Damage Ratings (0-10); 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not significantly differ (P•0.05, Duncan's multiple range test).

END OF SECTION H

SECTION I - PLANT PATHOLOGY/PHYTOPATHOLOGIE
- POTATOES/POMMES DE TERRES

- Reports/Rapports # 108-114
- Pages # 210-224

Section Editor: Ms. Agnes M. Murphy

RAPPORT # 108 **SECTION I: POMMES DE TERRES**

CULTURES: Pomme de terre, cv. Green Mountain
RAVAGEUR: Mildiou de la pomme de terre, *Phytophthora infestans* (Mont.) de Bary.

NOM ET ORGANISME:
TARTIER, L. ET LAPLANTE, R.
Centre de recherche et d'expérimentation agricoles, MAPAQ, C.P. 480, Saint-Hyacinthe, Québec, J2S 7B8
Tél. (514) 778-6522 **Télécopieur:** (514) 778-6539
Email: Leon.tartier@agr.gouv.qc.ca

TITRE: ÉVALUATION DE FONGICIDES POUR LUTTER CONTRE LE MILDIOU DE LA POMME DE TERRE EN 1996

PRODUITS: TATTOO C (propamocarbe/chlorothalonil), BRAVO 500 (chlorothalonil), BRAVO WEATHER STICK (chlorothalonil), IB 11925 (fluazinam/chlorothalonil), RH 7281, DITHANE DF (mancozèbe), CURZATE M8 (cymoxanil), CURZATE M12 (cymoxanil/mancozèbe), RIDOMIL GOLD 68 WP (métalaxyl.M/mancozèbe), ACROBAT MZ (dodémorphe/mancozèbe).

MÉTHODES: Le dispositif expérimental consistait en 15 traitements répartis au hasard et à quatre répétitions. Chaque parcelle comprenait quatre rangs de 10 m de long, 1 mètre entre les rangs. Les fongicides ont été appliqués à l'aide d'un pulvérisateur à la pression de 2000 KPa et un débit de 1040 L/ha. La contamination des parcelles par le mildiou a été réalisée par l'introduction de plants malades en pots de 2 gallons. Ces pommes de terre en pots ont été inoculées à l'aide d'une suspension de zoospores (9000 spore/ml) d'une souche US-8 de *P. infestans*. Les plants mildiousés ont ensuite été introduits dans les parcelles en placant un pot sur un rang extérieur de chacune des parcelles. A partir de ces plants malades, le mildiou s'est alors répandu dans les essais. Le défanage avec 3.5 L/ha de REGLONE a été réalisé le 5 septembre et la récolte les 24, 26 et 27 septembre.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Grâce à des conditions météorologiques favorables, le mildiou s'est répandu rapidement dans les parcelles témoins. Dans les autres parcelles les fongicides ont réussi à contrôler la maladie. Il y a eu très peu de contamination des tubercules, les conditions étant peu favorables à ce moment-là. Les rendements obtenus par les traitements fongicides ont été significativement supérieurs au témoin.

Traitements et doses d'emploi à l'hectare	Dates des traitements	%feuillage mildiousé au 6 sept. (échelle Barratt-Horsfall)	Rendements T/ha Tubercules No. 1
RH 7281,175 g + DITHANE DF, 1750 g +LATRON 0.12% v/v	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	55.5 a
RH 7281,262 g + DITHANE DF,1750 g +LATRON 0.12% v/v	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	54.6 a
IB 11925, 2.0 L	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	52.9 ab
RH 7281,350 g + DITHANE DF,1750 g +LATRON 0.12% v/v	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	52.5 ab
ACROBAT MZ, 2.5 Kg ou DITHANE DG, 2.25 Kg	3,18,31/7; 10,24/7,7,14,21,28/8;4/9	2.34	51.5 abc
TATTOO C, 2.7 L (2 fois) ou BRAVO 500, 2.5 L	10,24/7 3,18,31/7;14,21,28/8;4/9	2.34	49.5 abc
RIDOMIL GOLD 68WP, 2.5 Kg ou DITHANE DG,2.25 Kg	3,18,31/7; 10,24/7;7,14,21,28/8;4/9	2.34	47.5 abc
BRAVO 500, 1.25-2.50 L	3,10,18,24,31/7; 7,14,21,28/8;4/9	3.51	47.2 abc
DITHANE DF,2.25 Kg	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	46.7 abc
BRAVO WEATHER STICK, 1.75 L	3,10,18,24,31/7; 7,14,21,28/8; 4/9	2.34	46.7 abc
RIDOMIL MZ 72W, 2.5 Kg ou DITHANE DG, 2.25 Kg	3,18,31/7 10,24/7;14,21,28/8;4/9	2.34	44.7 abc
TATTOO C, 2.7 L (3 fois) ou BRAVO 500, 2.5 L	10,24/7;7/8 3,17,31/7;14,21,28/8;4/9	2.34	44.5 abc
CURZATE M12,2.34 Kg ou MANZATE 200DF,2.24 Kg	3,10,18,24,31/7;7,14/8 21,28/8; 4/9	2.34	44.1 abc
CURZATE M8, 1.67Kg ou MANZATE 200DF, 2.24 Kg	3,10,18,24,31/7; 7,14/8 21,28/8; 4/9	2.34	40.1 bc
TÉMOIN	-	91.8	17.6 d

RAPPORT # 109 **SECTION I: POMMES DE TERRE**

CULTURES: Pomme de terre, cv. Green Mountain
RAVAGEUR: Mildiou de la pomme de terre, *Phytophthora infestans* (Mont.) de Bary.

NOM ET ORGANISME:
TARTIER, L. ET LAPLANTE, R.
Centre de recherche et d'expérimentation agricoles, MAPAQ, C.P. 480, Saint-Hyacinthe, Québec, J2S 7B8
Tél.: (514) 778-6522 **Télécopieur**: (514) 778-6539
Email: Leon.tartier@agr.gouv.qc.ca

TITRE: **ÉVALUATION DE FONGICIDES POUR LUTTER CONTRE LE MILDIOU DE LA POMME DE TERRE EN 1995**

PRODUITS: IB 11925 (fluazinam/chlorothalonil), DITHANE DG (mancozèbe), TATTOO (propamocarbe/mancozèbe), CURZATE M-8 (cymoxanil/mancozèbe), BRAVO 500 (chlorothalonil), RIDOMIL MZ 72W (métalaxyl/mancozèbe).

MÉTHODES: Le dispositif expérimental consistait en 8 traitements répartis au hasard et à quatre répétitions. Chaque parcelle comprenait quatre rangs de 10 m de long, 1 mètre entre les rangs. Les fongicides ont été appliqués à l'aide d'un pulvérisateur à la pression de 2000 KPa et un débit de 1040 L/ha. Un plant sur chacun des rangs extérieurs des parcelles a été inoculé avec une suspension de spores d'une souche A2 de *P. infestans*. Par la suite, le mildiou a gagné l'intérieur des parcelles. Le défanage a été réalisé le 6 et 12 septembre avec 1.75 L/ha de REGLONE et la récolte a eu lieu le 20 septembre.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: La saison 1995 n'a pas été une année très favorable au mildiou de la pomme de terre. Le mois de juin et une partie de juillet ont été secs. Par la suite, les conditions météorologiques ont été plus favorables. Le mildiou s'est bien répandu dans les parcelles témoin; dans les autres parcelles les traitements fongicides ont en général contrôlé le mildiou de façon satisfaisante sauf dans les parcelle de CURZATE M-8 et dans celles ou le TATTOO a été utilisé à tous les 14 jours. Les rendements obtenus avec les traitements fongicides ont été significativement supérieurs aux témoins.

Traitements dose d'emploi à l'hectare	Dates des traitements	%feuillage mildiousé au 6 sept. (échelle Barratt-Horsfall)	Rendements T/ha Tubercules No. 1
IB 11925, 2.0 L	12,19,26/7;2,9,16,23,30/8; 6/9	6.44	37.4 a
DITHANE DG, 2.25 Kg	28/6;5,11112,19,26,/7; 2,9,16,23,30/8;6/9	4.68	35.0 a
BRAVO 500 1.25-2.50 L	28/6;5,12,19,26/7;2,9,16,23, 30/8; 6/9	5.26	34.2 a
RIDOMIL MZ 72 W, 2.5 Kg	28/6; 12/7	4.09	34.2 a
ou DITHANE DG, 2.25 Kg	5,17,26/7;2,9,16,23,30/8;6/9		
TATTOO, 4 L aux 7 jours	28/6; 5,12,19,26/7; 2,9,16, 23,30/8; 6/9	7.02	30.8 a
CURZATE M.8 1.0 Kg	28/6; 5,12,19,26/7; 2,9,16, 23,30/8; 6/9	10.54	30.0 a
TATTOO, 4 L aux 14 jours	28/6; 12,26/7; 9,28/8; 6/9	14.06	29.9 a
TÉMOIN	-	85.94	16.1 b

PMR REPORT # 110 **SECTION I: POTATO**
STUDY DATA BASE: 390 1252 9201

CROP: Potato, cvs Shepody and White Rose
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

NAME AND AGENCY:
BROOKES V R
Agriculture & Agri-Food Canada, PARC,
Agassiz, B.C. V0M 1A0
Tel: (604) 796-2221 **Fax:** (604) 796-0359 **Email:** BROOKES@EM.AGR.CA

TITLE: **EFFICACY OF RIDOMIL AND RIDOMIL GOLD AGAINST LATE BLIGHT ON POTATOES, 1996**

MATERIALS: RIDOMIL MZ 72WP (metalaxyl 8%, mancozeb 64%), RIDOMIL GOLD MZ 68WP (metalaxyl 4%,mancozeb 64%), ZINEB 80WP (Zineb)

METHODS: The trial was conducted in an experimental plot of potatoes at the Abbotsford substation of PARC-Agassiz. The crop rows were planted May 31 and spaced 0.9 m apart, the spacing between plants within rows was 0.3 m. There were two rows of potatoes in each plot, one of Shepody and one of White Rose. Each plot was replicated 4 times. The sprays were applied with a pressurized, hand-held sprayer. The spray was directed onto the top and exposed sides of each row. The first spray was applied when plants were 20 - 25 cm tall, prior to plants touching within the row. RIDOMIL MZ 72WP and RIDOMIL GOLD MZ 68WP applications were made on July 11, July 29 and August 13. Both RIDOMIL formulations were alternated with ZINEB applications made on July 22 and August 6. From August 1 visual ratings of blight severity were made. Development of the disease occurred from a natural infestation of blight that was in the field. Plots were harvested October 2 and 3 and marketable and cull weights were taken.

RESULTS: Late blight was observed on the potato leaves by September 1 only on the untreated plots. By September 18 all untreated plants were dead (rating 5) and there was some blight (rating 2) on the treated plots. Both fungicide treatments provided significant increase in marketable yield compared to the untreated check.

CONCLUSIONS: The fungicides tested effectively controlled late blight on potatoes.

Table 1. Visual rating of late blight on potato leaves treated with RIDOMIL MZ and RIDOMIL GOLD MZ alternated with ZINEB and untreated (0 = no blight effect, 5 = plants completely blighted, ie. dead)

Treatments	Rate	Shepody			White Rose		
	kg prod/ha	Sept 3	Sept 10	Sept 18	Sept 3	Sept 10	Sept 18
RIDOMIL MZ	2.5	0	0	1.5	0	1.5	2.0
+ ZINEB	3.0						
+ RIDOMIL MZ	2.5						
+ ZINEB	3.0						
+ RIDOMIL MZ	2.5						
RIDOMIL GOLD MZ	2.5	0	0	1.5	0	1.0	2.0
+ ZINEB	3.0						
+ RIDOMIL GOLD MZ	2.5						
+ ZINEB	3.0						
+ RIDOMIL GOLD MZ	2.5						
Check	---	2	3	5.0	3	4.0	5.0

Table 2. Comparison of marketable yield between RIDOMIL MZ and RIDOMIL GOLD MZ alternated with ZINEB treated plots and untreated plots of Shepody and White Rose potatoes in 1996.*

Treatments	Rate kg prod/ha	Shepody Market yield (kg/5 m row)	White Rose Market yield (kg/5 m row)
RIDOMIL MZ	2.5	23.8 a	18.0 a
+ ZINEB	3.0		
+ RIDOMIL MZ	2.5		
+ ZINEB	3.0		
+ RIDOMIL MZ	2.5		
RIDOMIL GOLD MZ	2.5	25.3 a	19.1 a
+ ZINEB	3.0		
+ RIDOMIL GOLD MZ	2.5		
+ ZINEB	3.0		
+ RIDOMIL GOLD MZ	2.5		
Check	---	19.7 b	16.3 b

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P<0.05)

PMR REPORT # 111 **SECTION I:** **POTATOES**
STUDY DATA BASE: 303-1251-9301

CROP: Potato, CV. Kennebec
PEST: Common scab, Streptomyces scabies
Stem rot, black scurf, *Rhizoctonia solani*

NAME AND AGENCY:
JOHNSTON, H. W.
Agriculture and Agri-Food Canada Research Center,
Box 1210, Charlottetown, Prince Edward Island, C1A 7M8,
Tel:(902) 566-6863 **Fax:** (902) 566-6821 **eMail:**johnstonw@em.agr.ca

TITLE: EFFICACY OF FUNGICIDE TUBER TREATMENTS FOR CONTROL OF *RHIZOCTONIA SOLANI* AND *STREPTOMYCES SCABIES*, 1996.

MATERIALS: MONCEREN (pencycuron, DS12.5%), RIZOLEX (tolclofos-methyl, 10%), EASOUT (thiophanate-methyl, 10%), MAXIM (fludioxonil, 0.33 or 0.5%), MERTEC (thiabendazole, 45DF).

METHODS: This trial was conducted at the Harrington Research Farm on land not previously cropped to potatoes for at least the past 9 years. Standard production practices for potatoes were followed in regards to tillage, fertility, weed, insect and foliar disease control (for early and late blight). Tubers of Elite 3 Kennebec were separated into healthy, free from visible sclerotia, and diseased, those with noticible sclerotia of *R. solani*. A complete randomized field design was used of 6 replicates, each plot being of 2 rows, 6 m long. One row was used for destructive sampling for disease assessments on 25 September and the other for yield determinations following top-killing on 27 September. For disease assessments, one stem and associated stolons and roots was removed from each of 10 hills for scoring severity of characteristic symptoms of *Rhizoctonia* on stems, stolons and roots using a scale of 1-7. Fifteen tubers/plot were rated for common scab and black scurf severity shortly after initiation of storage. Disease severity ratings for both diseases were completed by rating the percentage of tuber surface area lesioned. Tuber yield was reported as standard grades for potatoes. A further disease severity rating of tubers will be conducted and available from the author after March 1997.

RESULTS: see Tables below.

CONCLUSIONS: The tubers graded healthy illustrated symptoms of silver scurf (*Helminthosporium solani*) to almost a 100% level and this may have resulted in less difference in yield of healthy and diseased (by *R. solani*) tubers than previously experienced. A number of compounds including MONCERN, RIZOLEX, MAXIM (0.33 and 0.5% DP-A), EASOUT and MERTEC did not improve emergence to the level of the healthy checks. These same treatments generally illustrated less plant vigour than other treatments or healthy checks. Some treatments resulted in slight improvements in vegetative health compared to the diseased checks but none improved health beyond that of the healthy checks. Initial tuber health ratings illustrated substantial differences between healthy and diseased checks for black scurf but not scab severity. Treatments excepting EASOUT, EASOUT (PSPT) and MERTEC decreased black scurf severity. No fungicide tuber treatment improved either total or marketable yields over that of either check but MERTEC may have decreased tuber yields.

Table 1. Effect of fungicide treatments on emergence and vegetative plant health of Kennebec potatoes.

	Rate		Vigour**	Disease severity***		
Treatment	g/100Kg	Emergence*	(1-4)	Stems	Roots	Stolons
CONTROLS - Diseased	Nil	34.0	1.0	4.2	4.0	3.7
- Healthy	Nil	34.7	1.4	3.7	3.6	3.3
FUNGICIDES:						
MONCERN	25 ai	29.2	1.3	3.8	3.7	3.3
RIZOLEX	20 ai	28.0	1.8	3.8	3.8	3.1
EASOUT	500 pr	31.3	1.0	3.8	3.6	3.1
MAXIM(0.5% DP-A)	500 pr	30.1	1.1	3.6	3.6	3.0
MAXIM(0.33% PSPT-CAN)	500 pr	34.1	1.1	3.5	3.5	3.0
MAXIM(0.33% DP-A)	500 pr	29.5	1.5	3.6	3.5	3.0
MAXIM(0.33%)+ EASOUT(5%)	500 pr	33.5	1.0	3.8	3.7	3.1
EASOUT (PSPT)	500 pr	31.0	1.0	3.5	3.7	3.3
MERTEC	0.1 ai	27.4	1.7	4.2	3.9	3.5
LSD (0.05)		3.96	0.26	0.43	0.46	0.45

* plants/ha X 1000
** Vigour: 1-best, 4-worst
*** Severity of *Rhizoctonia* symptoms; 1 no symptoms, 7 severe lesioning

Table 2. Efficacy of fungicide treatments on tuber disease severity and yield of Kennebec potatoes.

Treatment*	Tuber disease severity**		Yield (T/ha)	
	Scurf	Scab	Marketable	Total
CONTROLS - Diseased	10.7	1.7	41.77	45.76
- Healthy	4.6	1.5	42.73	46.90
FUNGICIDES:				
MONCERN	2.0	2.2	41.76	46.07
RIZOLEX	2.0	2.9	38.70	41.76
EASOUT	6.6	2.1	42.48	46.70
MAXIM (0.5%DP-A)	2.2	1.8	41.76	46.56
MAXIM (0.33% PSPT-CAN)	5.0	2.2	42.98	46.73
MAXIM (0.33%DP-A)	2.7	3.2	39.09	42.76
MAXIM (0.33%DP-A)+ EASOUT (0.5%)	2.7	2.4	42.42	45.96
EASOUT (PSPT)	7.3	2.7	40.29	45.67
MERTEC	6.2	2.4	35.91	39.17
LSD (0.05)	4.25	1.82	5.652	5.596

* Treatments as in Table 1.

** area of harvested tubers lesioned.

PMR REPORT # 112 SECTION I: POTATOES

CROP: Potatoes, cv. Kennebec

PESTS: *Fusarium* species, *Rhizoctonia solani* Khun, *Streptomyces scabies* (Thaxt.) Waks. & Henrici, and *Verticillium* species

NAME AND AGENCY:
PLATT H W and MACLEAN V M
Agriculture and Agri-Food Canada, Charlottetown Research Centre, P.O. Box 1210, Charlottetown, Prince Edward Island, C1A 7M8
Tel: 902-566-6839 **Fax:** 566-6821 **Email:** PLATTH@EM.AGR.CA

TITLE: EFFICACY OF CHEMICAL CONTROL PRODUCTS FOR CONTROL OF SOIL-BORNE POTATO DISEASES CAUSED BY SOIL-BORNE FUNGAL PATHOGENS IN 1995

MATERIALS: In a field study, the following seed treatments were tested: thiophanate-methyl (EASOUT 10 D; 10% d; Ciba-Geigy) and mancozeb (DITHANE M45; 80% WP; Rohm & Haas) applied at 0.5 g a.i. kg^{-1} ; captan (ORTHOCIDE; 7.5% d; Zeneca) applied at 75 g a.i. kg^{-1}; metiram (POLYRAM; 16%nd; BASF) at 0.45 kg a.i. kg^{-1}; chlorothalonil (BRAVO 500F; 40.4% e.c.; ISK - Biosciences) applied as a 1% seed dip (240 ml of product : 24 L of water); FLUAZINAM (FLUAZINAM; 40.4% e.c.; ISK - Biosciences) applied as a 1% seed dip (240 ml of product:24L of water); and five experimental treatments from Rhone Poulenc: RP3 (0.133% triticonazole + 0.33% iprodione); RP4 (0.133% triticonazole + 0.67% iprodione); RP5 (0.267% triticonazole + 0.33% iprodione); RP6 (0.267% triticonazole + 0.67% iprodione); and RP9(0.33% triticonazole) applied at 10+25, 10+50, 20+25, 20+50, and 25 g a.i. t^{-1} of seed, respectively.

METHODS: Elite 3 seed (cv Kennebec) was used that had received no "fall" fungicide treatment prior to storage. Immediately after cutting and just before planting, the seed was treated with the fungicides. Fungicide treatments were applied by shaking tubers in a plastic bag for 3-5 min. with the appropriate fungicide treatment. Controls consisted of seed without fungicide applied. Immediately after treating , the seed was hand-planted in 3.0 m rows with 0.3 m in-row and 0.9 m between-row spacings in a randomized complete block design. Plant emergence, vigor, and disease determinations throughout the season were made. Top desiccant was applied about mid-September and plots were harvested two weeks later. Post-harvest disease incidence (%) and severity (0-4 scale) assessments were made for tuber surface disorders such as common scab and for tuber stem-end vascular tissue discoloration (after removing a 3-5 mm cross-section) following tuber grading.

RESULTS: All data were subjected to analysis of variance and mean separation tests (Table 1). No differences in total plant stand were observed among any of the treatments or the untreated control. Seed rots were generally caused by rhizoctonia but a few had bacterial rots. Plant wilt incidence and occurrence of plant chlorosis increased throughout the season. EASOUT treated plots had a higher incidence of wilt than the untreated plots while ORTHOCIDE and RP5 significantly reduced the level of wilt as compared to the untreated plots. The remaining fungicide treatments did not differ from the untreated plots. RP5 was the only treatemnt that had significantly less plant chlorosis than the untreated plots. Significant differences were also found among treatments in tuber yield. RP3, RP6 and RP9 produced significantly fewer small (0-54 mm) tubers than untreated. All other treatments did not differ in their production of small tubers from that in the untreated plots. Yield of tubers sized 55-85 mm was reduced significantly in plots treated with EASOUT, POLYRAM, RP5, RP9, FLUAZINAM, and BRAVO. Plots treated with ORTHOCIDE produced significantly more 55-85 mm tubers than the untreated. Treatments of ORTHOCIDE and POLYRAM significantly reduced the yield of large tubers (<85 mm) from that of the untreated while plots treated with RP6 had an increased yield of large tubers. Total tuber yield was reduced significantly from that of the untreated with EASOUT, POLYRAM, BRAVO and FLUAZINAM. No significant differences were found among the treatments in terms of the incidence and severity of common scab and black scurf.

CONCLUSIONS: The chemicals tested appear to be ineffective at reducing the level of common scab and black scurf on the surface of tubers. While some treatments reduced both market (55-85 mm) and total tuber yields, ORTHOCIDE increased the yield of market sized tubers. Although some reduction in disease symptoms occurred mid season, these results did not translate into increased yields in all cases. Further studies will be conducted prior to the final assessment of the value of these treatments and prior to determining a final recommendation on these chemicals.

Table 1. Evaluation of fungicides for soilborne potato disease and tuber yield in 1995.

Treatment	Plant Wilt(%)	Plant Chlorosis(%)	Tuber Yields (t/ha) 0-54 mm	55-85 mm	>85 mm	Total
ORTHOCIDE	32.2	1.6	10.4	26.7	5.1	44.9
BRAVO 500	72.5	2.1	7.8	17.1	5.7	30.0
FLUAZINAM	61.0	1.3	7.3	12.6	5.8	26.2
DITHANE M45	52.2	2.2	9.3	19.4	6.0	35.9
POLYRAM	77.7	2.4	7.7	14.5	4.8	26.0
RP3	61.0	0.9	5.1	22.6	14.2	40.0
RP4	76.7	2.3	7.1	19.4	13.1	39.2
RP5	13.4	0.6	7.4	13.6	10.4	33.7
RP6	65.1	1.4	5.0	17.9	23.7	46.4
RP9	43.4	1.1	5.6	13.0	16.0	34.9
EASOUT	95.1	1.7	7.2	16.4	9.0	28.2
Untreated	67.7	1.9	8.7	21.3	13.2	42.7
LSD (*P*=0.05)	21.20	1.09	2.30	3.54	7.66	10.55

PMR REPORT # 113 **SECTION I: POTATOES**

CROP: Potatoes, cv. Green Mountain
PESTS: *Alternaria solani* (Ell. & Martin) Sor., *Phytophthora infestans* (Mont.) DeBary

NAME AND AGENCY:
PLATT H W and REDDIN R D
Agriculture & Agri-Food Canada, Charlottetown Research Centre,
PO Box 1210, Charlottetown, PEI C1A 7M8
Tel: 902-566-6839 **Fax**: 566-6821 **Email**: PLATTH@EM.AGR.CA

TITLE: FUNGICIDE EFFICACIES FOR CONTROL OF EARLY AND LATE BLIGHT OF POTATOES IN 1995

MATERIALS: The following treatments were applied: chlorothalonil (BRAVO 500 and BRAVO 720;40% EC; ISK- Biosciences) at 1.8 and 1.3 litres a.i. ha^{-1} every 7 days; chlorothalonil (BRAVO 720; 40% EC; ISK- Biosciences) at 1.3 litres a.i. ha^{-1} every 7 days but with propamocarb and mancozeb (TATTOO; 72% EC; AgrEvo) at 4.0 litres a.i. ha^{-1} on 3 occasions beginning on 12 July and then every 7 days or beginning on 12 July and then every 14 days; mancozeb and cymoxanil (CURZATE M8; 72% WP; Dupont) at 1.0 kg a.i. ha^{-1} every 7; dimethomorph (ACROBAT; 50% WP; Cyanamid) and dimethomorph plus mancozeb (DITHANE; 75% DG; Rohm & Haas) at 0.225 kg a.i. ha^{-1} and 0.225 kg a.i. ha^{-1} plus 1.5 kg a.i. ha^{-1}, respectively, every 14 days; copper hydroxide(KOCIDE 101; 72% WP; Griffin) plus mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.68 kg a.i. ha^{-1} and 2.0 kg a.i. ha^{-1}, respectively, every 7 days; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 1.33 and 1.75 kg a.i. ha^{-1} every 7 days; mancozeb (DITHANE; 75% DG; Rohm & Haas) at 2.25 kg a.i. ha^{-1} every 7 days but with metalaxyl + mancozeb (RIDOMIL MZ; 72% WP; Ciba Geigy) at 1.75 kg a.i. ha^{-1} on 3 occasions beginning on 12 July and then every 14 days; triphenyltin hydroxide (SUPERTIN; 80% WP; Griffin) plus mancozeb (DITHANE M-45; 80% w.p ; Rohm & Haas) at 0.175 kg and 1.75 kg a.i. ha^{-1}, respectively, every 7 days; and propamocarb and mancozeb (TATTOO; 72% EC; AgrEvo) at 4 litres a.i. ha^{-1} every 7 or 14 days. Untreated, control plots did not receive any fungicide applications.

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1995. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), green sprouted, Elite 3 seed tubers (cv Green Mountain) were hand-planted 30 cm apart and recommended crop management practices were followed. Plant emergence counts on the centre row of each five-row plot were made 40-50 days post-planting. Fungicides were first applied to the foliage on 6 July. A sporangial suspension of *Phytophthora infestans* (races 1-4) was applied to the foliage of plants in the two outer rows of each five-row plot 2-3 days after the first fungicide application and as required thereafter. Plots were mist irrigated (3-5 mm hr^{-1} for 2-4 hr periods) during July and August to maintain the disease in the inoculated rows. Late blight damage (amount of diseased foliage as a percentage of total plant foliage)in plants in the centre row of each five-row plot were made throughout August and September. Natural occurring inoculum of *Alternaria solani* were relied upon for establishment of early blight. Early blight incidence (amount of diseased foliage as a percentage of total plant foliage) and severity (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate and 3 = severe with 25% or more of the foliage having many lesions)in plants in the centre row of each five-row plot were made throughout August and September. Fungicide applications (tractor-mounted sprayer modified to spray only the centre three rows with three hollow-cone nozzles/row, 450 L/ha volume, 860 kPa) were first made a few days before inoculation and/or according to the treatment application schedule. Top desiccant was applied mid-late September, two weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (% by weight) were determined. All data were subjected to analysis of variance (arcsin transformation of percentage data was done prior to analysis).

RESULTS: Plant emergence was 100% in all plots. Symptoms of early blight and late blight increased throughout the season in all plots. Fungicide treatments significantly reduced the development of early blight and the disease level attained compared to the untreated control plots (Table 1). However, treatments of ACROBAT (14 days) and BRAVO 720 (7 days) did not effectively reduce the level of early blight below levels found in the control plots. Fungicide treatments were found to significantly slow disease progress for late blight during the growing season compared to that found in the untreated control plots. But applications of ACROBAT (14 days), BRAVO 720 and TATTOO (14 days) had significantly higher levels of foliar late blight as compared to many other fungicides in this trial. All treatments significantly reduced tuber late blight levels relative to non-treated plots. Reduced levels of late blight in the plots did not result in higher tuber yields in the plots in all cases. However, the majority of fungicide treatments did result in significantly higher tuber yields than the untreated.

CONCLUSIONS: The majority of fungicides tested in this trial prevented foliar damage due to late blight and early blight. Most of the chemical treatment plots also resulted in increased total tuber yields and the application of fungicides significantly reduced the level of late blight tuber rot. Further evaluation of the new fungicides and combinations in this study are required prior to detailed recommendation.

Table 1. Evaluation of fungicides for early and late blight and their effect on potato yields in 1995. *t/ha

Treatment		App.	Early	Late Blight*		Total
	Rate ai ha^{-1}	No.	Blight (%)	Foliar	Tuber	Yield
ACROBAT	0.23 kg	5	49	58	1.0	43.2
ACROBAT+DITHANE	0.23 kg+1.5 kg	5	14	7	0.1	46.3
CURZATE M8	1.0 kg	10	16	7	1.5	46.9
BRAVO 720	1.3 L	11	46	32	0.2	45.9
BRAVO 720+TATTOO	1.3 L+4 L	11+3	16	5	1.1	48.0
KOCIDE 101+DITHANE	1.7 kg+1.5 kg	11	20	2	0.5	46.2
DITHANE M45	1.3 kg	11	21	1	1.2	48.3
DITHANE M45	1.8 kg	11	16	1	0.3	48.2
DITHANE M45 + RIDOMIL MZ	1.8 kg+1.8 kg	11+3	14	7	1.0	50.3
BRAVO 500	0.8 L	11	13	13	0.2	50.4
BRAVO 500 + RIDOMIL MZ	0.8 L+1.8 kg	11+3	14	4	0.6	48.4
SUPERTIN + DITHANE M45	0.17 kg+1.75 kg	11	17	0	0.3	46.3
TATTOO 7D	4 L	10	16	3	0.8	46.2
TATTOO 14D	4 L	5	40	21	0.5	45.7
Untreated	0	0	58	93	4.0	41.7
SED (df 167)	-	-	4.7	5.4	0.49	1.72

PMR REPORT # 114 **SECTION I: POTATOES**

CROP: Potato, cv. Russet Norkotah
PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

NAME AND AGENCY:

THOMSON, C, ZGRABLIC, D, KOEMAN, J and ORMROD, D.
British Columbia Ministry of Agriculture, Fisheries and Food
1767 Angus Campbell Road, Abbotsford, B.C. V3G 2M3

TITLE: EFFICACY OF FUNGICIDES AGAINST LATE BLIGHT OF POTATO, 1996

MATERIALS: 1. DITHANE DG (75% mancozeb) @ 2.25 kg/ha every 10 days.
2. DITHANE DG @ 1.75 kg/ha plus RH-7281 80WP (RH-117, 281 a.i.) @ 175 g/ha plus LATRON B-1956 as spreader sticker @ 0.12% V/V every 10 days.
3. DITHANE DG @ 1.75 kg/ha + RH-7281 @ 350 g/ha + LATRON B-1956 every 10 days.
4. CURZATE M-8 (8% cymoxanil plus 64% mancozeb) @ 1.67 kg/ha every 7 days.
5. CURZATE M-12 (Curzate M-8 with extra mancozeb) Curzate M-8 @ 1.67 kg/ha plus Manzate 200 75% DF @ 0.67 kg/ha every 7 days.
6. CURZATE M-8 and MANZATE 200 "Program Approach" Manzate 200 DF(75% mancozeb) @ 2.24 kg/ha alternated with Curzate M-8 @ 1.67 kg/ha every 7 days in the following sequence: MMCCMCCM.
7. ACROBAT MZ (9% dimethomorph plus 60% mancozeb) @ 2.5 kg/ha applied once followed by DITHANE DG @ 2.25 kg/ha every 7-10 days.
8. ACROBAT MZ @ 2.5 kg/ha applied twice followed by DITHANE DG @ 2.25 kg/ha every 7-10 days.
9. ACROBAT MZ @ 2.5 kg/ha applied early followed by DITHANE DG @ 2.25 kg/ha every 7-10 days plus ACROBAT MZ @ 2.5 kg/ha after topkill.
10. PENNCOZEB DF (75% mancozeb) @ 2.24 kg/ha every 7-10 days.

11. MANEB DF (75% maneb) @ 2.24 kg/ha every 7-10 days.
12. TD 2343-02 F (420 g/L mancozeb) @ 4.7 L/ha every 7-10 days.
13. TD 2343-02 F @ 3.5 L/ha every 7-10 days.
14. ICIA 5504 WG (80% azoxystrobin) @ 156 g/ha plus BOND (synthetic latex adjuvant) @ 0.125 % V/V applied twice, alternated with MAESTRO WG (75% captan) @ 2.67 kg/ha every 7-10days.
15. ICIA 5504 WG @ 156 g/ha plus MAESTRO WG @ 1.33 kg/ha plus BOND @ 0.125 % V/V applied twice, alternated with MAESTRO @ 2.67 kg/ha every 7-10 days.
16. ICIA 5504 WG @ 312 g/ha plus BOND @ 0.125% V/V applied twice alternated with MAESTRO WG @ 2.67 kg/ha every 7-10 days.
17. RIDOMIL MZ (64% mancozeb plus 8% metalaxyl) @ 2.5 kg/ha alternated with DITHANE DG @ 2.25 kg/ha every 7-10 days with a maximum of 3 applications of Ridomil MZ.
18. RIDOMIL GOLD MZ (64% mancozeb plus 4% metalaxyl-M) @ 2.5 kg/ha alternated with DITHANE DG @ 2.25 kg/ha every 7-10 days with a maximum of 3 applications of Ridomil Gold.
19. BRAVO 500 (500g/L chlorothalonil) @ variable rate from 1.26 L/ha to 1.68 L/ha; then 2.52 L/ha every 7-10 days.
20. IB11522 (chlorothalonil) @ 1.75 L/ha every 7-10 days.
21. IB11925 (chlorothalonil) @ 2.05 L/ha every 7-10 days.
22. IB11925 @ variable rate from 1.17 L/ha to 1.75 L/ha; then 2.05 L/ha every 7-10 days.
23. BRAVO ZN (chlorothalonil plus zinc) @ variable rate from 1.26 L/ha to 1.68 L/ha; then 2.52 L/ha every 7-10 days.
24. BRAVO ZN @ 2.52L /ha every 7-10 days.
25. KOCIDE 101 (copper hydroxide; metallic copper equivalent 50%) @ variable rate 1.7-3.4 kg/ha every 7-10 days plus one application @ 3.4 kg/ha after vine kill.
26. KOCIDE 2000 (copper hydroxide; metallic copper equivalent 35%) @ variable rate 1.3-2.5 kg/ha every 7-10 days plus one application @ 2.25 kg/ha after vine kill.
27. KOCIDE 101 @ variable rate 1.1-2.25 kg/ha plus DITHANE DG @ variable rate 1.75-2.25 kg/ha every 7-10 days plus one application of KOCIDE 101 @ 3.4 kg/ha after vine-kill.
28. MANKOCIDE (copper hydroxide; metallic copper equivalent 30% plus 15% mancozeb) @ variable rate 1.7-3.4 kg/ha every 7-10 days.
29. SUPERTIN WP (80% triphenyltin hydroxide) @ 200g/ha plus DITHANE DG @ variable rate 1.12-2.25 kg/ha every 7-10 days.
30. KOCIDE 2000 @ variable rate 1.3-2.5 kg/ha plus DITHANE DG @ variable rate 1.12-2.25 kg/ha every 7-10 days plus one application of KOCIDE 2000 @ 2.25 kg/ha after vine kill.
31. TATTOO C (375 g/L propamocarb hydrochloride plus 375 g/L chlorothalonil) @ 2.7 L/ha twice, alternated with BRAVO 500 @ variable rate from 1.26 L/ha to 1.68 L/ha, then 2.52 L/ha every 7-10 days.
32. TATTOO C @ 2.7 L/ha three times, alternated with BRAVO 500 @ variable rate as in # 31 every 7-10 days.
33. NON-FUNGICIDAL flowable formulation base @ 3.0 L/ha every 10-14 days.
34. BIOCONTROL extract formulated with # 33 @ 3.0 L/ha.
35. DIVA (14% iprodione plus 29% chlorothalonil) @ 3.5 L/ha every 10 days.
36. RPA 407213 DF (70% imidazolinone) @ 300 ml/ha plus DITHANE DG @ variable rate, 1.0-2.25 kg/ha every 7 days.
37. ARACHIDONIC ACID @ 10^{-6}-10^{-7} M solution applied to seed-pieces just prior to planting.
38. ARACHIDONIC ACID as in # 37 plus foliar spray with KH_2PO_4 @ 3.6 kg/ha every 10-14 days.
39. KH_2PO_4 foliar spray @ 3.6 kg/ha every 10-14 days.

40. UNTREATED CONTROL.

METHODS: Cut seed-pieces of Elite III Russet Norkotah potatoes were planted using a two-row planter on June 5, 1996 in a clay loam soil at Langley, B.C. The same field had grown potatoes in 1993, 1994 and 1995. Experimental plots were 6m long x 2m wide with approximately 1m bare ground between plots on all sides and with 4 replications arranged in a randomized complete block design. Fungicides were applied according to manufacturers' directions in a volume of 400 L/ha using a hand sprayer beginning July 10 and ending on September 6. Diazinon 500 EC was applied July 1 & 27 and August 25 at the rate of 500ml in 375 L of water/ha, for control of tuber flea beetle and aphids. Lorox was applied prior to potato emergence for initial weed control at the rate of 2.2 L/ha on June 14.

The field was artificially inoculated on August 30 by placing infected potato leaves collected from Cumberland B.C., a small farming community 200 km north of Victoria, in the middle of each plot.

At the first appearance of late blight on September 5, an overall plant condition rating was done to determine if there were treatment differences preceding the arrival of blight. Two late blight assessments were then done on September 13 and 18, respectively and a final condition rating combining the effects of late blight and other factors was done on September 20. In all cases, a 0-10 rating system was used with 0 being a dead plant in the condition rating or no infection in the blight rating. A rating of 10 meant 100% healthy topgrowth in the condition rating or 100% of the foliage destroyed in the blight rating. If there were no blighted plants in a plot, ten plants were rated and all received zeros. If one or more plants in a plot had blight, all the plants in the plot were rated. The crop was top-killed with Reglone on September 25 at the rate of 2L in 500 L of water/ha. Potatoes were harvested on October 31 and November 1. Yields of marketable, unmarketable and infected tubers were recorded. The marketable tubers were bagged in burlap sacks and placed in storage for observations on rot development. Analysis of variance and a Tukey-Kramer test were carried out on the data for all observations except storage rot which had not been completed at the time of writing. Samples of infected leaves were forwarded to Simon Fraser University in Burnaby, B.C. and to Agriculture and Agri-Food Canada in Charlottetown, P.E.I. for typing.

RESULTS: Results are shown in Table I. For consistency, all plant condition and blight severity ratings were done by one person (C.T.). At harvest, several different workers were involved in sorting marketable, unmarketable and infected tubers. The results of the grading were, therefore, somewhat variable. This, combined with high random variation within the plot, precluded any significant differences in yield of sound tubers. However, there was a significant difference between treatments in yield of infected tubers. The predominant blight population in the plot as determined at both laboratories was the g-11 genotype which is an A1, metalaxyl-insensitive strain, the same one that occurred in the plot in 1995. However, an A2 population was also detected and it is believed that it was introduced during the artificial inoculation with leaves from Cumberland B.C.

CONCLUSIONS: Blight appeared in the plots on September 5 and spread rapidly thereafter. All of the manufacturers' candidate fungicides gave significant control of blight compared to the experimental treatments 34, 37, 38, 39 and the controls 33 & 40. Small differences between the fungicides were not statistically significant at the 5% level.

Table I. Effect of fungicides on plant condition, late blight severity and tuber yield in Russet Norkotah potatoes.

Treatment	Average Blight Severity (% blighted foliage)		Plant Condition Rating (% healthy foliage)		Tuber Yield Infected (t/ha)	Yield Sound Tuber (t/ha)
	Sept.13	Sept.18	Sept.5	Sept.20		
1	0.2 b*	1.0 c	55 a	34 bc	2.9 c	35.6 a
2	0.4 b	0.0 c	55 a	32 bc	3.5 bc	28.7 a
3	0.0 b	0.0 c	56 a	36 bc	3.5 bc	32.1 a
4	0.0 b	0.0 c	54 a	33 bc	4.2 abc	29.0 a
5	0.0 b	0.0 c	55 a	31 bc	5.6 abc	25.8 a
6	0.0 b	1.6 c	54 a	28 bc	8.7 abc	26.9 a
7	0.0 b	0.5 c	51 a	28 bc	3.1 b	27.3 a
8	0.5 b	0.0 c	54 a	22 bc	2.1 c	31.2 a
9	0.2 b	0.7 c	55 a	30 bc	2.5 c	34.8 a
10	0.0 b	0.2 c	60 a	31 bc	5.8 abc	27.5 a
11	0.0 b	0.2 c	56 a	31 bc	8.7 abc	21.5 a
12	0.0 b	0.0 c	53 a	34 bc	3.7 bc	31.9 a
13	2.0 b	0.2 c	55 a	29 bc	7.3 abc	24.2 a
14	5.9 b	18.6 c	59 a	27 bc	1.9 c	29.6 a
15	0.9 b	5.9 c	52 a	26 bc	2.7 c	32.7 a
16	0.0 b	4.3 c	55 a	28 bc	3.7 bc	27.7 a
17	0.7 b	0.2 c	55 a	26 bc	3.5 bc	31.9 a
18	0.0 b	0.2 c	52 a	19 bc	4.8 abc	28.5 a
19	1.5 b	0.4 c	53 a	26 bc	8.1 abc	26.5 a
20	0.0 b	0.0 c	66 a	47 ab	1.7 c	37.9 a
21	0.0 b	0.0 c	54 a	27 bc	1.2 c	39.8 a
22	0.0 b	0.2 c	58 a	40 bc	2.3 c	32.9 a
23	0.0 b	0.0 c	61 a	35 bc	4.0 bc	33.1 a
24	0.0 b	0.0 c	53 a	29 bc	1.9 c	31.7 a
25	0.6 b	7.3 c	61 a	39 bc	5.2 abc	34.4 a
26	0.1 b	2.7 c	62 a	36 bc	10.2 abc	20.8 a
27	1.6 b	3.6 c	61 a	33 bc	3.5 bc	35.0 a
28	1.5 b	1.1 c	58 a	29 bc	11.0 abc	22.3 a
29	0.0 b	0.9 c	56 a	30 bc	2.1 c	29.2 a
30	1.0 b	0.4 c	52 a	26 bc	4.0 bc	28.5 a
31	0.0 b	0.0 c	52 a	28 bc	0.6 c	29.0 a
32	0.0 b	0.0 c	53 a	31 bc	3.7 bc	32.1 a
33	22.0 ab	53.0 b	53 a	10 bc	14.6 abc	18.7 a
34	31.0 a	59.0 ab	61 a	13 bc	19.2 a	14.2 a
35	0.0 b	1.0 c	63 a	40 bc	2.9 bc	38.1a
36	0.2 b	0.5 c	53 a	21 bc	7.5 abc	23.1 a
37	25.0 ab	61.0 ab	65 a	14 bc	9.0 abc	23.1 a
38	43.0 a	75.0 ab	67 a	14 bc	17.7 ab	19.2 a
39	31.0 a	81.0 a	45 a	5 cd	8.5 abc	24.2 a
40	31.0 a	72.0 ab	57 a	8 cd	10.4 abc	23.1 a

* Means followed by the same letter in each column do not differ significantly ($P<0.05$) as verified by Tukey-Kramer test.

END OF SECTION I

SECTION J - PLANT PATHOLOGY/PHYTOPATHOLOGIE
- CEREAL, FORAGE AND OILSEED CROPS /CÉRÉALES,CULTURES FOURRAGÈES ET OLÉAGINEUX

- Reports/Rapports # 115- 129
- Pages # 225-250

Section Editors: **Richard A. Martin**
H. Winston Johnston
Jim G. Menzies

PMR REPORT # 115 **SECTION J:** **DISEASES OF CEREAL, FORAGE AND OILSEED CROPS**

CROP: Alfalfa
PEST: Blossom blight, *Botrytis cinerea* and *Sclerotinia sclerotiorum*

NAME AND AGENCY:
HOLLEY J D
AAFRD, Crop Diversification Centre - South, S.S. #4, Brooks, AB T1R 1E6
Tel: (403) 362-1336 **Fax**: (403) 362-1306 **Email**: jholley@eid.awinc.com
GOSSEN B D
AAFC Research Centre, 107 Science Place, Saskatoon, SK S7N 0X2
Tel: (306) 956-7259 **Fax**: (306) 956-7242 **Email**: gossenb@em.agr.ca
HARRISON L M
AAFRD, Provincial Building, P.O. Box 159, Fairview, AB T0H 1L0
Tel: (403) 835-2291 **Fax**: (403) 835-3600 **Email**: harrisol@agric.gov.ab.ca
SMITH S R
Dept. Of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2
Tel: (204) 474-6504 **Fax**: (204) 261-5732
Email: srsmith@bldgagric.lan1.umanitoba.ca

TITLE: EFFECTS OF FUNGICIDE APPLICATION ON LEVELS OF BLOSSOM BLIGHT INFECTION AND YIELD IN ALFALFA

MATERIALS: BENLATE (benomyl, 50% WP); BRAVO 500 (chlorothalonil, 50% F); RONILAN (vinclozolin, 50% WP)

METHODS: The efficacy of three fungicides in reducing alfalfa blossom blight infection from *Botrytis cinerea* and *Sclerotinia sclerotiorum* was evaluated in 12 commercial seed fields in 1996; 3 in Alberta (AB), 3 in Saskatchewan (SK), and 6 in Manitoba (MB).

In Alberta, three sprays, BENLATE (0.8 kg a.i. ha^{-1}), BRAVO 500 (1.4 kg a.i. ha^{-1}) and RONILAN (1.1 kg a.i. ha^{-1}) were applied first when the crop was in mid to full bloom in early to mid July and then again 10 to 14 days later. Unfortunately, there wasn't enough fungicide to spray large plot replicates at one of the three sites twice. Plots were arranged in randomized complete block designs (RCBD) with 4 or 6 replicates. Plots replicates ranged in size from 0.02 ha to 2 ha in area. Mature florets were removed from each plot 4-7 days after each spray application and plated onto potato dextrose agar amended with lactic acid without being surface sterilized. The number of florets infected with *S. sclerotiorum*, or *B. cinerea*, were recorded for all replicates at each sample site for each sample time. Results from each set of isolation plates were expressed as percentages of flowers infected with each pathogen. Data from all sites, were combined, analyzed and summarized below. Seed was harvested from 1.7 ha sprayed plots at one site. Yield data was not collected at the other two sites because plot sizes were small and stands in them too uneven to give reliable results.

In SK, plots 12 X 6 m (0.01 ha) were arranged in a 4 replicate RCBD. Fungicide treatments were as above, with one additional treatment; a late only application. A late spring delayed flowering, so the first fungicide spray was applied in late July. Flower samples were collected after the late fungicide application at one site. Seed was harvested from 30m^2 plot replicates at all sites. In MB, flower samples were taken from 2 replicates in strip blocks sprayed once with Benlate early in July. Unfortunately, yields are not currently available.

RESULTS: In Alberta, Benlate and Ronilan reduced infection from *S. sclerotiorum* early in the season when inoculum levels were relatively high (Table 1). Field levels, however, decreased later in the season as a result of unfavorable warm dry weather (Tables 1, 2). This decrease may have confounded the effects of fungicide application on petal infection (Table 2). Benlate was the only fungicide that reduced *B. cinerea* infection when inoculum levels were low (Table 1). Benlate and two applications of Ronilan reduced petal infection when Benlate or Ronilan were greater than those in the unsprayed check at Enchant by 18.6% and 16.8% respectively (Table 5).

In Saskatchewan, *B. cinerea* was isolated from alfalfa blossoms much more frequently than *S. sclerotiorum* (Table 3). Benlate decreased petal infection and increased yields by 25-50% at all three sites (Tables 3, 6). Bravo or Ronilan did not reduce flower infection in 1996 in SK (Table 3). Two applications of Bravo increased yield at one site but failed to do so at two others (Table 6). Ronilan had no impact on yield.

In Manitoba, mean percent recovery (Table 4) showed that *B. cinerea* and *S. sclerotiorum* were isolated in roughly equal proportions from infected blossoms in MB in 1996. A single application of Benlate reduced the incidence of both pathogens at several sites.

CONCLUSIONS: Application of Benlate effectively reduced blossom blight infection and increased seed yields at sites all across the prairie region. Ronilan reduced petal infection and increased yield in Alberta, where *S. sclerotiorum* was common, but failed to do so in Saskatchewan where *B. cinerea* predominated.

ACKNOWLEDGEMENT: Thanks to the ADF, AARI, CSGA and MII for financial assistance, ISK BioSciences and BASF for fungicides, to R. Linowski for his co-operation and to K. Bassendowski, R. Endersby, J. Kramer, Z. Lan, S. Lisowski, and C. Toews for technical assistance.

Table 1. Incidence (%) of *Sclerotinia sclerotiorum* (Ss) and *Botrytis cinerea* (Bc) in alfalfa flower samples after a single application of Benlate, Bravo 500 or Ronilan in three commercial seed fields in Alberta in 1996.

Fungicide Applied	Ss --- Pathogen Recovered	-- Bc
Benlate	7.1 b*	6.5 b
Bravo 500	24.0 a	17.5 a
Ronilan	11.4 b	15.4 a
Control	24.2 a	19.4 a

* Means in columns followed by the same letter did not differ from each other according to a protected Duncan's test at P• 0.05.

Table 2. Incidence of (%) *Sclerotinia sclerotiorum* (Ss) and *Botrytis cinerea* (Bc) in alfalfa flower samples in plots sprayed once or twice with Benlate, Bravo 500 or Ronilan after the second spray application in two commercial seed fields in Alberta in 1996.

Fungicide Applied	No. of Spray Applic.	Ss---Pathogen Recovered---Bc	
		Ss	Bc
Benlate	1	5.0 c*	31.3 c
Benlate	2	9.2 b	15.4 d
Bravo 500	1	12.5 ab	50.0 a
Bravo 500	2	3.8 c	39.6 b
Ronilan	1	10.8 ab	43.3 ab
Ronilan	2	14.2 a	28.3 c
Control	0	14.6 a	43.3 ab

* Means in columns followed by the same letter did not differ from each other according to a protected Duncan's test at P• 0.01.

Table 3. Incidence (%) of *Sclerotinia sclerotiorum* (Ss) and *Botrytis cinerea* (Bc) in alfalfa flower samples after a single application of Benlate, Bravo 500 or Ronilan at three commercial seed fields in Saskatchewan in 1996.

Fungicide Applied	Parkside**		Atwater		MacDowell		Mean	
	Bc	Ss	Bc	Ss	Bc	Ss	Bc	Ss
Benlate	53 a*	0 a	85 a	23 a	10 a	10 a	49 a	11 a
Bravo	88 b	10 a	85 a	23 a	58 b	0 a	77 b	11 a
Ronilan	90 b	0 a	78 a	15 a	45 b	0 a	71 b	5 a
Control	98 b	18 a	80 a	20 a	48 b	8 a	75 b	15 a

* Means in columns followed by the same letter did not differ from each other according to a protected Duncan's test at P• 0.05. ** Site.

Table 4. Incidence (%) of *Sclerotinia sclerotiorum* (Ss) and *Botrytis cinerea* (Bc) in alfalfa flower samples after a single application of Benlate at six commercial seed fields in Manitoba in 1996.

	Treatment			
Site	Bc--Benlate---Ss		Bc---Control---Ss	
	Bc	Ss	Bc	Ss
Arberg	15	45	18	55
Seven Sisters	58	23	100	5
Fisher Branch	18	20	53	33
Lac Du Bonnet	33	25	15	40
Miami	20	13	78	35
Rosenort	33	63	38	78
Mean	30	32	50	41

Table 5. Impact of one application of Benlate and Ronilan on seed yield (kg/ha)in large (2 ha) plots at Enchant, AB in 1996.

Fungicide applied	Means of Seed Weights at Harvest (kg/ha)
Benlate	293.800 a*
Ronilan	289.325 a
Control	247.700 b

* Means in columns followed by the same letter did not differ from each other according to a protected Duncan's test at P• 0.05.

Table 6. Impact of fungicide application on seed yield (kg/ha) at three commercial seed fields in Saskatchewan in 1996.

Fungicide	Application		Site	
Applied	Time(s)	Parkside	Atwater	MacDowell
Benlate	Early	150 ab*	400 abcd	190 a
Benlate	Late	140 abc	370 d	190 a
Benlate	Early + Late	190 a	470 a	170 ab
Bravo	Early	110 bc	450 abc	170 ab
Bravo	Late	130 bc	470 ab	110 b
Ronilan	Early	110 bc	420 abcd	140 ab
Ronilan	Late	110 bc	360 d	140 ab
Ronilan	Early + Late	100 bc	390 bcd	130 ab
Control	Not Applied	90 c	380 cd	130 ab

* Means in columns followed by the same letter did not differ from each other according to a protected Duncan's test at P• 0.05.

PMR REPORT # 116 **SECTION J: CEREAL, FORAGE AND OILSEED CROPS**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison
PEST: Net blotch, *Pyrenophora teres*

NAME and AGENCY:
MARTIN R A, and MATTERS R
Agriculture and Agri-Food Canada, Research Centre, P.O. Box 1210,
Charlottetown, PEI C1A 7M8
Tel: (902) 566-6851, **Fax**:(902) 566-6821, **Internet**: MARTINRA@EM.AGR.CA

TITLE: THE EFFECTS OF SINGLE OR DOUBLE APPLICATIONS OF FOLIAR FUNGICIDES ON NET BLOTCH IN BARLEY, 1996

MATERIALS: TILT (propiconazole 250 EC), FOLICUR (hexaconazole), BAS 480 (epoxiconazole 125 g/l SC)

METHODS: Barley plots were established on May 15, 1996, at a seeding rate of 300 viable seeds per m^2. Each plot was ten rows wide, 17.8 cm between rows, and five meters long. Treatments were replicated four times in a randomized complete block design.

The fungicides listed above were applied at three different application schedules. Single applications were made at Zadok's Growth Stage (ZGS) 30 or 45-49, with the double application made at ZGS 30 followed by a second application at ZGS 45-49. Applications were made using a CO_2 backpack sprayer, applying water at a rate of 500 L ha^{-1}, at a pressure of 200kPa.

Net blotch symptoms were assessed at ZGS 83 (July 24). The penultimate and third leaves were rated on 10 randomly selected tillers per plot using the Horsfall & Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: All of the fungicide applications had a significant control effect on net blotch severity on the second leaf (penultimate) however the single applications of FOLICUR had no effect on disease severity on the third leaf (Table 1). FOLICUR had no significant effect on yield, nor did the late single applications of the low rate of BAS 480 or TILT. There were no significant yield differences between the single early versus the single late applications of TILT or BAS 480. The combined applications at ZGS 30 plus 45-49 were the maximum yielding treatments with a top increase of approximately 1100 kg/ha (37.4%) with BAS 480 (75 g ai/ha) with no significant difference between low or high rates.

CONCLUSIONS: The 1996 growing season was very conducive to the development of net blotch, as reflected in high severity levels relatively early in the season. This early and severe disease level resulted in yield responses to both early and late applications. In addition the double application response reflected disease severity and benefit that treatment can impart. In past years studies single late applications provided for the maximum return from treatment. However the early appearance and high severity levels of net blotch in 1996 were such that maximum yield benefit depended on a double application. Some of the lack of activity associated with FOLICUR application in this trial, compared to previous studies at the same location, may have in part been due to the lack of a surfactant being used at application.

Yield response was significantly correlated ($P=0.01$) with disease severity on both the 2nd and 3rd leaves ($r=-0.625$ and -0.581 respectively) indicating that at least a portion of the yield benefit from treatment was directly related to net blotch reduction.

Table 1. Influence of foliar treatments on net blotch severity and yield in Morrison barley.

Treatment	Rate*	Timing*	Net Blotch 07/20		Yield (kg/ha)	1000 kwt (g)
			2nd leaf (%)	3rd leaf (%)		
UNTREATED	0	-	34.1	89.3	2930	27.06
TILT	125	30	18.3	68.2	3365	29.28
TILT	125	30+45	5.0	48.0	3852	32.71
TILT	125	45	13.0	67.1	3140	31.47
BAS 480	75	30	13.9	63.4	3650	32.16
BAS 480	75	30+45	4.2	28.0	4095	34.15
BAS 480	75	45	9.4	55.3	3285	32.78
BAS 480	100	30	9.5	49.9	3475	31.37
BAS 480	100	30+45	4.3	33.1	4030	36.41
BAS 480	100	45	9.3	70.9	3610	32.45
FOLICUR	125	30	18.7	81.9	3055	28.70
FOLICUR	125	30+45	17.5	69.7	3315	31.16
FOLICUR	125	45	13.8	80.1	3075	30.15
SEM***			2.98	5.63	146.1	0.883
LSD (P=0.05)			8.56	16.2	419	2.53

* Rate - g a.i./ha, each application timing
** Timing - Zadok's Growth Stage(s) at time of application
*** SEM - Standard Error of Mean

PMR REPORT # 117 **SECTION J: CEREAL, FORAGE AND OILSEED CROPS**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison
PEST: Seedling blight, various; Net blotch, *Pyrenophora teres*
Scald, *Rhynchosporium secalis*

NAME and AGENCY:
MARTIN R A, and MATTERS R
Agriculture and Agri-Food Canada, Research Centre, P.O. Box 1210,
Charlottetown, PEI C1A 7M8
Tel: (902) 566-6851, **Fax**:(902) 566-6821, **Internet**: MARTINRA@EM.AGR.CA

TITLE: INFLUENCE OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD IN BARLEY, 1996

MATERIALS: VITAFLO 280 (UBI2051-1, carbathiin 14.9%, thiram 13.2%), UBI2383-1 (BAYTAN 30, triadimenol 317 g/L), TF3770A (hexaconazole 5.0 g/L), UBI2584-3 (Raxil, tebuconazole 8.37 g/L), UBI2092-1 (Vitaflo 250, carbathiin 282 g/L), UBI2454-1 (RH3866 50 g/l).

METHODS: Certified barley seed, cv. Morrison, was treated with the fungicides listed above at the rates listed in the table, in a small batch seed treater. Barley plots were established on May 15, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was ten rows wide and five metres long, 17.8 cm between rows. Treatments were replicated four times in a randomized complete block design.

Emergence was determined from counts on two metres of row per plot. At Zadok's Growth Stage (ZGS) 45, seedling blight, and foliar net blotch and scald were each assessed on one metre length of row using a 0-9 scale where 0 = no disease symptoms and 9 = severe disease symptoms. At ZGS 83 foliar net blotch was again rated, on the penultimate and third leaves of 10 randomly selected tillers per plot using the Horsfall & Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine centre rows, using a small plot combine.

RESULTS: All seed treatment evaluated significantly reduced the severity of seedling blight and of early net blotch severity. While there were some small differences between some treatments most were not significantly different form other seed treatments (Table 1). There were no significant effects of any treatment on early season scald or late season net blotch severity (data not presented). All treatments which contained RH3866 (UBI2454-1) or BAYTAN (UBI2383-1) resulted in significant yield increases of between 265 kg/ha (8.3%) and 415 kg/ha (12.9%). Treatments had no significant effect on emergence.

CONCLUSIONS: Conditions in 1996 were very conducive to the development of net blotch. While there were some reductions in late season net blotch these were not significant, possibly due to the high disease pressure. Seed treatments did have a positive effect on early disease levels with some maintaining an influence which is reflected in yield benefits (RH3866 and BAYTAN).

Table 1. Influence of seed treatments on net blotch severity and yield in Morrison barley

Treatment	Rate*	Seedling Blight ZGS 45 (0-9)	Net Blotch ZGS 45 (0-9)	Net Blotch ZGS 83 2nd leaf (%)	Net Blotch ZGS 83 3rd leaf (%)	Yield kg/ha)	1000 kwt (g)
UNTREATED	0	4.9	5.2	10.9	63.0	3210	35.29
VITAFLO 280	0.65	2.8	1.8	6.7	50.0	3420	34.79
VITAFLO 280	0.93	3.3	2.8	7.9	44.6	3285	35.39
TF3770-A	0.01	2.8	2.5	9.3	59.9	3410	35.11
UBI2092-1	0.55	2.8	2.0	8.1	48.7	3350	36.28
UBI2092-1 + UBI2454-1	0.55 + 0.04	2.0	2.0	7.5	48.7	3475	34.76
UBI2092-1 + UBI2454-1	0.55 + 0.06	2.8	2.0	9.3	59.0	3625	35.09
UBI2584-3	0.015	3.0	3.0	11.1	64.1	3290	34.40
UBI2584-3	0.02	2.5	2.3	9.4	61.0	3415	35.56
UBI2383-1	0.15	2.3	1.8	12.1	47.5	3550	37.59
VITAFLO 280 + UBI2383-1	0.65 + 0.15	2.0	1.5	5.3	44.2	3570	36.16
SEM**		0.426	0.324	2.295	7.86	85.3	0.736
LSD (P=0.05)		1.23	0.94	6.63	NS	246	2.125

* Rate - g a.i./kg seed

** SEM - Standard Error of Mean

STUDY DATA BASE: 385-1212-9503

CROP: Barley, cv Harrington
PEST: Scald, *Rhynchosporium secalis*

NAME AND AGENCY:
ORR D D, TURKINGTON T K
Agriculture and Agri-Food Canada, 6000 C & E Trail, Lacombe, AB T4L 1W1
Tel: (403) 782-8133 **Fax:** (403) 782-6120 **Email:** orrd@em.agr.ca
BURNETT P A
Agriculture and Agri-Food Canada, P.O. Box 3000 Main, Lethbridge, AB T1J 4B1
Tel: (403) 327-4591 **Fax:** (403) 382-3156

TITLE: THE EFFECT OF SEED DRESSINGS ON EARLY SCALD INFECTION - LACOMBE 1996

MATERIALS: UBI 2100-4 (VITAVAX SINGLE, 23% carbathiin), UBI 2051-1 (VITAFLO-280, 14.9% carbathiin and 13.2% thiram), UBI 2383-1 (BAYTAN, 30% triadimenol), UBI 2584-1 (.833% tebuconazole).

METHODS: Seed was collected in 1994 from plots of Harrington which showed severe symptoms of scald infection on the leaves. This seed was treated with the chemicals listed above using the rates in Table 1 and a small batch laboratory seed treater. The seed was air dried and seeded May 23 into 4 row plots 5.5 m long with 23 cm row spacing. Two rows of wheat were seeded between plots to limit disease spread. Dried straw with severe scald infection was spread onto the plots June 3. On June 3, a suspension of 2.4×10^4 spores/mL of *R. secalis*, artifically cultured on lima bean agar, were sprayed onto the plots to runoff. Emergence was counted in 2 - 1 m rows on June 12. An early disease score of the number of leaves/m with lesions was taken June 21. On July 10, just prior to heading, 10 randomly selected tillers/plot were rated on a 0-9 scale with 3 rating 0% disease on the upper leaf canopy, 1% on the middle, and 10% on the lower leaves and 7 rating 10-25% on the upper leaf canopy, >50% on the middle, and >50% on the lower leaves. At maturity the plots were combine harvested and the grain cleaned before yields and kernel weights were taken.

RESULTS: The results are presented in Table 1. There were no significant differences in emergence for any treatment, although UBI 2383-1 averaged 8 more plants/m than the untreated control. UBI 2383-1 had significantly less disease than the other treatments in the June score, but there were no differences between treatments by July. Both UBI 2100-4 and UBI 2383-1 had significantly higher yields and 1000 kernel weights than the untreated check.

CONCLUSIONS: UBI 2383-1 confers protection from seed-borne or early scald infection which appears to result in higher yields and 1000 kernel weights. The early disease protection was not apparent 48 days after seeding, when the plants were heading.

Table 1. The effect of seed dressings on early scald infection, Lacombe 1996

Treatment	g a.i. /kg seed	Emergence #/m	June Disease Score*	July Disease Score**	Kg/ha	1000 Kernel Wt (g)
UBI 2100-4	.55	37	35	3	4792	42.6
UBI 2051-1	.55 + .49	38	30	3	4421	42.1
UBI 2383-1	.15	47	8	3	4910	43.3
UBI 2584-1	.02	42	29	3	4430	41.5
Untreated	--	39	37	3	4550	40.9
LSD (P=.05)		ns	8.6	ns	225	1.2

* June disease score = # leaves with scald lesions/m

** July disease score = 0-9 scale where 3 = 0% disease on the upper canopy, 1% on the middle, and 10% on the lower leaves.

PMR REPORT # 119 SECTION J: CEREAL, FORAGE, AND OILSEED CROPS

CROP: Canola, cv. Legacy
PEST: Sclerotinia Stem Rot, *Sclerotinia sclerotiorum*

NAME AND AGENCY:
KHARBANDA P D, LANGE R M and OSTASHEWSKI M J
Alberta Research Council, Bag 4000, VEGREVILLE, AB T9C 1T4
Tel: (403) 632-8227 **Fax:** (403) 632-8379 **Email:** prem@aec.arc.ab.ca

TITLE: EFFICACY OF FUNGICIDAL FOLIAR SPRAYS TO CONTROL SCLEROTINIA STEM ROT OF CANOLA, 1996

MATERIALS: BENLATE 50DF (benomyl 50%); ICIA 5504 80WG (azoxystrobin 80%); IKF-1216 (50%); FOLICUR 3.6 F (tebuconazole 38.7%); BOND (adjuvant).

METHODS: Canola seed (*Brassica napus* cv. Legacy)was planted on May 24 in a 30m x 30m block in rows 20 cm apart. Seed was treated with Vitavax RS to control seed-borne diseases, and Furadan 5G was added to the seed rows to control flea beetles. Plots, 6m x 2m, were marked using flags. Experimental design was a randomized complete block with four replications. At the 3-4 leaf stage, *S. sclerotiorum* sclerotia were spread throughout the canola block. At 10% flowering (July 15), one set of canola plots were sprayed with IKF-1216 at 470 g ai/ha. All other treatments were sprayed at 25% flowering on July 19. On July 24, plots were inoculated with *S. sclerotiorum* by lightly spraying a suspension containing mycelial fragments of the fungus. The suspension was prepared by macerating actively growing cultures of *S. sclerotiorum* on potato dextrose agar. Two, 10cm Petri plates were used to prepare one liter of the suspension. Sclerotinia stem rot incidence was recorded by counting infected stems after crop harvest on September 19 and 20. To determine yield, five meter sections from the two middle rows of each plot were harvested by hand and bagged. The number of infected stems in the harvested sections were then counted in each plot. Plants were threshed upon drying, and the seed was cleaned and weighed. Percent stem infection and yield data were square root transformed to normalize the data.

RESULTS: Results are presented in the table below.

CONCLUSIONS: ICIA 5504 was the most effective treatment when used with the adjuvant Bond. ICIA 5504, at the low rate, significantly reduced Sclerotinia disease incidence and percent green seeds, and also significantly improved 1000-seed weight over the untreated check. IKF-1216 applied at 10 percent flowering also significantly reduced disease incidence over the untreated check as did Benlate at 25% flowering.

Table 1. Effect of foliage applied fungicides on sclerotinia stem rot disease incidence, seed yield and seed quality in *Brassica napus* cv. Legacy in field trials at Vegreville, 1996.*

Treatment	Rate (g ai/ha)	Flowering (%)	%Infected Stems**	TSW (g)	%Green Seeds	Yield** (g)
Check	--	--	3.48 a	3.16 b	3.16 b	22.5 a
BENLATE	1250	25	2.34 bc	3.43 ab	3.43 ab	24.6 a
IKF-1216	470	10	2.02 c	3.34 ab	3.34 ab	23.1 a
IKF-1216	470	25	3.16 ab	3.40 ab	3.40 ab	24.4 a
IKF-1216	500	25	2.58 abc	3.38 ab	3.38 ab	24.5 a
FOLICUR	200	25	2.86 abc	3.23 b	3.23 b	24.1 a
ICIA 5504	125	25	2.65 abc	3.37 ab	3.37 ab	24.5 a
ICIA 5504	250	25	1.99 c	3.48 ab	3.48 ab	24.6 a
ICIA 5504 + BOND	125	25	2.06 bc	3.67 a	3.67 a	24.1 a
ICIA 5504 + BOND	250	25	2.17 bc	3.49 ab	3.49 ab	25.6 a

* TSW = 1000-seed weight. Mean of 4 replications; means within a column followed by the same letter do not differ significantly according to Duncan's Multiple Range Test (P=0.05).

** Analysis performed on square root transformed data.

PMR REPORT # 120 SECTION J: CEREAL, FORAGE, AND OILSEED CROPS

CROP: Canola, cv. Reward
PEST: Alternaria blackspot, *Alternaria brassicae*

NAME AND AGENCY:
KHARBANDA P D, LANGE R M and WEREZUK S P
Alberta Research Council, Bag 4000, VEGREVILLE, AB T9C 1T4
Tel: (403) 632-8227 **Fax:** (403) 632-8379 **Email:** prem@aec.arc.ab.ca

TITLE: EFFECT OF FUNGICIDAL FOLIAR SPRAYS TO CONTROL ALTERNARIA BLACKSPOT OF CANOLA, 1996

MATERIALS: BRAVO 500 (chlorothalonil 50%); IB11522 (chlorothalonil); ICIA 5504 WG (azoxystrobin 80%); ROVRAL FLO (iprodione 25%); BOND (adjuvant).

METHODS: Canola seed (*Brassica rapa* cv. Reward) was planted in 6 m x 1.2 m plots consisting of 4 rows, 20 cm apart with a spacing of 60 cm between plots on May 17. Seed was treated with Vitavax RS to control seed-borne diseases, and Furadan 5G was added to the seed row to control flea beetles. All treatments were replicated four times in a randomized complete block design. Border plots of cv.

Reward were seeded on both ends of the experiment. At 100% bloom (August 8) plots were inoculated with a suspension containing spores and mycelial fragments of *A. brassicae*. The inoculum was prepared by macerating profusely sporulating cultures of the fungus grown on potato dextrose agar. The fungicides were sprayed at manufacturers' recommended rates at 95% petal fall, on July 26. Disease severity was estimated at crop maturity (August 20) on a scale of 0-6 based on pod surface area affected with blackspot as follows: 0=no disease, 1=0-1%, 2=1-5%, 3=5-10%, 4=10-25%, 5=25-50%, and 6=50-100%. In each plot, disease was evaluated at three randomly chosen spots; 10 plants were evaluated for pod infection at each spot. To determine yield, 5 m sections of the two middle rows in each plot were harvested by hand and bagged on August 21 and 22. Plants were threshed upon drying and seed was cleaned and weighed.

To determine *Alternaria* infection in the harvested seed, 100 seeds from each fungicidal treatment were plated on V-8 juice agar supplemented with 40 mg/L rose bengal and antibiotics. The seed was plated at a rate of 25 seeds per plate replicated four times. All plates were arranged in a completely randomized block design and incubated at 24• C under fluorescent lights using a cycle of 12 h light/12 h dark. Infected seeds were counted after 7 days incubation. All data were analyzed statistically. Infected seed count and yield data were square root transformed to normalize the data.

RESULTS: Results are presented in the table below.

CONCLUSIONS: Rovral Flo and high rate of ICIA 5504 + BOND significantly reduced disease severity on pods, increased 1000-seed weight, and reduced percent green seeds compared with the untreated check.

Table 1. Effect of fungicidal foliar sprays on blackspot disease severity, seed yield, and seed quality in *Brassica rapa* cv. Reward in field trials at Vegreville, 1996.*

Treatment	Rate (g ai/ha)	MDS	TSW (g)	%Green Seeds	%Infected Seeds**	Yield** (g)
Check	--	4.33 a	2.49 de	4.25 a	4.37 ab	25.8 ab
BRAVO 500	925	4.17 a	2.50 de	2.75 ab	3.47 ab	24.5 b
BRAVO 500	1235	3.92 ab	2.51 de	3.00 ab	4.72 ab	26.7 ab
IB11522	620	4.25 a	2.45 e	2.75 ab	3.08 b	25.7 ab
IB11522	928	4.25 a	2.55 cde	2.75 ab	4.04 ab	25.7 ab
ICIA 5504	125	3.92 ab	2.63 bcd	2.00 ab	4.78 ab	27.0 ab
ICIA 5504	250	3.92 ab	2.69 abc	2.00 ab	3.28 ab	27.0 ab
ICIA 5504 + BOND	125	3.42 bc	2.73 ab	2.25 ab	5.27 a	28.1 a
ICIA 5504 + BOND	250	3.08 c	2.74 ab	0.75 b	3.76 ab	25.7 ab
ROVRAL FLO	618	3.25 c	2.79 a	1.00 b	3.12 ab	27.1 ab

* MDS = Mean Disease Severity; TSW = 1000-seed weight. Mean of 4 replications; means within a column followed by the same letter do not differ significantly according to Duncan's Multiple Range Test (P=0.05).

** Analysis performed on square root transformed data.

PMR REPORT # 121 **SECTION J: CEREAL, FORAGE, AND OILSEED CROPS**

STUDY DATA BASE: 375-1411-8719

CROP: Canola, *Brassica rapa*, cultivar Tobin
PEST: Alternaria black spot, *Alternaria* spp.

NAME AND AGENCY:
REED S L, JONES-FLORY L L, DUCZEK L J, and SEIDLE E
Agriculture and Agri-Food Canada, Research Centre, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2
Tel: (306)956-7200 **Fax:** (306)956-7247 **Email:** duczekl@em.agr.ca
Seidle Seed Farm, Box 146, Medstead, Saskatchewan S0M 1W0

TITLE: EFFECT OF FUNGICIDE APPLICATION ON ALTERNARIA BLACK SPOT IN TOBIN CANOLA, 1996.

MATERIALS: BRAVO 500 (chlorothalonil 500g/L), IB11522 (chlorothalonil 500g/L), TILT (propiconazole 250g/L), ROVRAL FLO (iprodione 250g/L), ICIA5504 (azoxystrobin 800g/kg), BOND .125% (sticker).

METHODS: A randomized complete block test with four replicates was established in a commercially grown field of Tobin canola, at Medstead, Saskatchewan in 1996. The crop was seeded on May 28 with a press drill with 15 cm row spacings. Naturally occurring inoculum of *Alternaria* spp. was relied upon for infection. The test area was established on June 18 by rotovating a two meter area around each replicate. Plots within the replicates were five meters long by two meters wide. One row of crop on either side of the centre seven rows of each plot was removed. This created a walkway for spraying and marked out the area to be harvested. All treatments were sprayed using a hand-held, CO_2 pressurized, four nozzle boom sprayer at 35 psi fitted with Lurmark 01-F80 nozzles. The water volume was 100L/ha for the water control, ROVRAL FLO, ICIA5504, and TILT treatments, and 225L/ha for Bravo and IB11522 treatments. ROVRAL FLO 500gai, ROVRAL FLO 250gai, and ICIA5504 250gai were sprayed on July 12 when the plants were at 20 to 30% bloom. All other treatments including a water control were sprayed on July 30 at 95% petal drop. Ten main stems from each plot were visually assessed for disease on pods on August 21, when the seed was at the hard rolled stage, and just beginning to show colour change. Plots were harvested (7 rows x 5 m long) on September 18 and yield was recorded as kilograms per hectare of dry grain. Subsamples were taken from each plot and the seed was surface disinfested for 10 min with 0.6% sodium hypochlorite and then air dried. This seed was then used to determine percent germination and percent infection by the three *Alternaria* spp. - *A. alternata*, *A. brassicae*, and *A. raphani.* To determine percent germination 200 seeds/plot were vacuum plated (20 seeds/plate) onto 1.8% water agar amended with 100mg/L streptomycin and 50mg/L vancomycin. These plates were incubated at 18-24° C for 3-5 days, at which time germinated seed was counted and calculated as a percentage of the total seeds plated. Three hundred seeds/plot were plated (20 seeds/plate) on V-8 juice agar amended with 40mg/L rose bengal and 100mg/L streptomycin. After seven days under fluorescent lights (12 hour day/night cycle) at 18-24° C, the plates were examined for presence of the three *Alternaria* spp. The species were differentiated by examining colony morphology, and by determining spore shape and size under a compound microscope. Only *A. brassicae* was found in any significant number, therefore, only that species was analyzed. Results were reported as the percentage of total seed infested. Percent green seed was determined by crushing 500 seeds/plot and counting the number of green seeds. Thousand kernel weights were determined by weighing 500 seeds and multiplying by two. Sclerotinia stem rot and blackleg basal stem canker incidence were rated on the stubble of 40 plants which were randomly collected on September 18 from the water control and from treatments sprayed at 20-30% bloom. Data was analyzed using an analysis of variance procedure.

RESULTS: See Tables 1 and 2 below. Disease levels were relatively low (7.1% in the control), but all treatments significantly (P=0.05) reduced the incidence of black spot. There were no significant differences between treatments for sclerotinia and blackleg. Disease levels were low with an overall average of 2% of plants affected with sclerotinia stem rot and 15% of plants showing slightly diseased cankers of blackleg.

CONCLUSIONS: Application of any of the fungicides tested decreased the incidence of black spot in canola. Yield increased with all fungicide treatments except BRAVO, but not all of these increases were significant at P=0.05. The greatest increase in yield was 22% with ROVRAL FLO 250 gai sprayed at 95% petal drop. All fungicide treatments generally improved seed quality by decreasing green seed count and seed infestation with *A. brassicae*, and by increasing seed weight and germination. Both ROVRAL FLO and ICIA5504 demonstrated comparable results at full and half-rates, when applied at 95% petal drop. ROVRAL FLO 250 gai was more effective when applied at 20% bloom than at 95% petal drop.

Table 1. The effect of foliar applied fungicides on mean percent disease of alternaria black spot on main stem pods and yield of Tobin canola.

Product	Rate	Application*	Alt. Blk. Spot (% disease)	Yield (kg/ha) (/ha)
Control	---	2	7.1a**	2251.4d**
ROVRAL FLO	500gai	1	2.9b	2356.6cd
ROVRAL FLO	500gai	2	3.4b	2415.9bcd
ROVRAL FLO	250gai	1	0.3d	2425.6bcd
ROVRAL FLO	250gai	2	2.4bc	2743.3a
ICIA5504	250gai	1	2.1bcd	2442.7bcd
ICIA5504	125gai	2	0.7cd	2636.6ab
ICIA5504	250gai	2	0.4cd	2576.4abc
ICIA5504+Bond	250gai	2	0.4cd	2459.9bcd
BRAVO 500	2.47L	2	2.8b	2239.7d
IB11522	1.75L	2	2.2bcd	2508.2abc
TILT	250gai	2	1.8bcd	2430.0bcd

* 1=20% bloom; 2=95% petal drop.

** Values in the same column which are not followed by the same letter are significantly different at P=0.05 according to Duncan's Multiple Range Test.

Table 2. The effect of foliar applied fungicides on mean percent green seed, *A. brassicae* infection, thousand kernel weight, and percent germination of Tobin canola.

Product	Rate (/ha)	Application*	Green Seed(%)	*A. brassicae* (% infection)	1000 KWT (g)	Germination (%)
Control	---	2	5.2ab**	14.3a**	2.46cd**	89c**
ROVRAL FLO	500gai	1	4.4abc	8.8bc	2.50bcd	96ab
ROVRAL FLO	500gai	2	4.4abc	8.8bc	2.46cd	93abc
ROVRAL FLO	250gai	1	3.2c	4.8c	2.58ab	96a
ROVRAL FLO	250gai	2	4.3bc	11.8ab	2.58ab	94abc
ICIA5504	250gai	1	3.3c	9.5b	2.54abc	95abc
ICIA5504	125gai	2	3.5bc	7.9bc	2.63a	96ab
ICIA5504	250gai	2	3.2c	4.8c	2.58ab	98a
ICIA5504+Bond	250gai	2	2.8c	4.8c	2.62a	90bc
BRAVO 500	2.47L	2	6.2a	14.2a	2.39d	94abc
IB11522	1.75L	2	4.2bc	14.3a	2.48bcd	93abc
TILT	250gai	2	4.2 bc	9.0b	2.53abc	97a

* 1=20% bloom; 2=95% petal drop.

** Values in the same column which are not followed by the same letter aresignificantly different at P=0.05 according to Duncan's Multiple Range Test.

PMR REPORT # 122 **SECTION J: CEREAL, FORAGE, AND OILSEED CROPS**
STUDY DATA BASE: 375-1411-8719

CROP: Canola, *Brassica rapa*, cultivars Tobin and AC Sunshine
PEST: Alternaria black spot, *Alternaria* spp.

NAME AND AGENCY:
REED S L, JONES-FLORY L L, DUCZEK L J and SEIDLE E*
Agriculture and Agri-Food Canada, Research Centre, 107 Science Place,
Saskatoon, Saskatchewan S7N 0X2
Tel: (306)956-7200 **Fax:** (306)956-7247 **Email:** duczekl@em.agr.ca
* Seidle Seed Farm, Box 146, Medstead, Saskatchewan S0M 1W0.

TITLE: **EFFECT OF FUNGICIDE APPLICATION ON ALTERNARIA BLACK SPOT IN TOBIN AND AC SUNSHINE CANOLA, 1996.**

MATERIALS: ROVRAL FLO (iprodione 240g/L).

METHODS: Two test sites were established in 1996, in commercially grown fields, on Tobin canola at Canwood, SK, and on AC Sunshine canola at Lake Lenore, SK. Naturally occurring inoculum of *Alternaria* spp. was relied upon for infection. Each test was designed as a randomized complete block with four replicates. The test sites were established by rotovating a two meter area around each replicate. Plots were five meters long by two meters wide, with a one and one half meter guard area on either side of each plot. As both sites were air seeded, a one meter area at the centre of each plot was delineated by hoeing out an area 15cm wide on either side. This created a pathway for spraying to avoid crop damage and to define the area of the plot to be harvested. All treatments were sprayed using a hand-held, CO_2 pressurized, four nozzle boom sprayer, fitted with Lurmark 01-F80 nozzles, at 35 psi. The water volume was 100L/ha. The Canwood site was seeded on May 27 and the plots were set up June 27. All treatments were sprayed on July 3 at 95% petal drop. Percent disease was visually assessed on main stem pods of 10 randomly selected plants in each plot on August 9 when seeds in lower pods were green in colour and at the hard rolled stage. Harvest was done September 11 with yield recorded as kilograms per hectare of dry grain. The Lake Lenore site was seeded June 6 and the plots were set up July 23. Spraying occurred July 31 at 95% petal drop. Ten main stems from each plot were rated for disease on pods on August 23 when the seed colour change was at about 50%. Plots were harvested September 10. Seed subsamples were taken from each plot and were surface disinfested for 10 min in 0.6% sodium hypochlorite, then air dried. This seed was used to determine percent germination and to determine the percent infection of the different *Alternaria* spp. Two hundred seeds (20 seeds/plate) were vacuum plated onto 1.8% water agar containing 100mg/L streptomycin and 50mg/L vancomycin. These plates were incubated for 3-5 days at 18-24•C, then germinated seeds were counted and percent germination determined. Three hundred seeds(20 seeds/plate) were vacuum plated onto V-8 juice agar containing 50mg/L rose bengal and 100mg/L streptomycin. The plates were incubated under fluorescent lights (12 hour day/night cycle) at 18-24•C for 7 days. They were then examined to differentiate *A. alternata*, *A. brassicae*, and *A. raphani* colonies by examining colony morphology, and by determining spore shape and size under a compound microscope. Only *A. brassicae* was found in any significant number, therefore, only that species was analyzed. Results were reported as percent of total seed infested. Percentage green seed was determined by crushing 500 seeds/plot and counting the number of green seeds. Thousand kernel weights were determined by weighing 500 seeds and multiplying by two. Sclerotinia stem rot and blackleg basal stem canker were rated on the stubble of 40 plants which were randomly collected just after harvest from the control and the Rovral Flo 500 gai/ha plots. Data for the two locations was combined and analyzed using an analysis of variance procedure.

RESULTS: See Table 1 below. Data from the two locations was combined because the location by treatment interaction for the various variables were not significantly different except for disease level. Fungicide treatments decreased disease levels at both locations, but the amount of change at Lake Lenore, where disease levels were higher, was greater than at Canwood. The effect of ROVRAL FLO was similar in both locations. At Canwood there was some bertha army worm damage in the sprayed plots, as these remained green after the unsprayed crop had ripened. This may have resulted in a lower than expected yield in these plots. There was no sclerotinia stem rot recorded in the plots, although it did occur in the fields. There was no significant difference in blackleg between the treatments. Disease incidence was high, but disease severity was low as only slightly infected basal stem cankers of blackleg were found in an average of 47% of plants at Canwood and 33% at Lake Lenore.

CONCLUSIONS: Applying ROVRAL FLO at either full or half rate decreased alternaria black spot on pods and increased yield. The fungicide spray application decreased alternaria seed infestation and green seed count, and increased seed weight and seed germination. The full rate application appears to improve seed quality more than the half rate application.

Table 1. The effect of foliar applied fungicides on mean percent disease of alternaria black spot on main stem pods and yield of Polish canola, mean of two sites.

Product	Rate (/ha)	Alt. Blk. Spot (% disease)	Yield (kg/ha)	*A. brassicae* (%)	Green Seed(%)	1000 KWT(g)	Germ (%)
Control	----	12.6a*	1171.3b*	18.4a*	6.4a*	2.0c*	91b*
ROVRAL FLO	250gai	6.9b	1361.4a	10.1b	3.6b	2.2b	94ab
ROVRAL FLO	500gai	2.5c	1450.8a	3.3c	1.4c	2.4a	96a

* Values in the same column which are not followed by the same letter are significantly different P=0.05 according to Duncan's Multiple Range Test.

ACKNOWLEDGEMENT: The authors wish to thank Mr. Sheldon Rude and Mr. Reg Prodahl for their generous support of this research project.

PMR REPORT # 123 SECTION J: CEREAL, FORAGE, AND OOILSEED CROPS

CROP: Canola, cv. Hyola 401
PEST: Blackleg, *Leptospharia maculans*

NAME AND AGENCY:
ROURKE D R S, DOELL R J and BISHT V S
Ag-Quest Inc., Box 144, Minto, Manitoba R0K 1M0
Tel: (204) 776-2087 **Fax**: (204) 776-2250 **Email**:agquest@mail.techplus.com

TITLE: EFFICACY OF ICIA 5504 FOR BLACKLEG CONTROL IN HYOLA 401 CANOLA 1996

MATERIALS: ICIA 5504 (800 g/kg azorystrobin) BOND (450 g/l synthetic latex)

METHODS: The trial was conducted at Minto, MB. Hyola 401 canola was seeded at 8 kg/ha on May 25 with a double disc press drill. 80 kg/ha nitrogen was banded in the fall of 1995. 20 kg/ha P2O5 was banded at seeding. The trial was a randomized complete block with 4 replicates and a plot size of 2 m x 7.5 m. Plots were separated by a 2 m untreated check strip. Weeds were controlled with ethalfluralin @ 1.1 kg/ha, sethoxydim @ 0.2 kg/ha, ethametsulfuron @ 0.020 kg/ha and clopyralid @ 0.100 kg/ha. Benomyl @ 0.5 kg/ha was applied to control sclerotinia. Chlorpyrifos was applied @ .480 kg/ha to control Bertha armyworm. All rates are in kg a.i./ha. Fungicide treatments were applied on June 21 with a compressed air bicycle sprayer delivering 200 l/ha of water at 330 kPa with Lurmark 8004 flat fan nozzles. In treatments with surfactant, the ICIA 5504 was mixed with the water before the surfactant was added. The sprayer boom was approximately 40 cm above the plants, and angled forward 30 degrees. Treatments were applied at 10:00 am when air temperature was 12 C. The canola crop was at the 4 - 6 leaf stage. Blackleg lesions were visible on the lower leaves 7-10 days after fungicide application. Conditions were favorable for the development of blackleg, with frequent rain showers and warm temperatures in the month following fungicide application. Plots were evaluated for the degree of blackleg infection on August 28 using a 0-5 scale (0 = no infection and 5 = dead plants, completely girdled by the disease) used by the Western Canada Canola and Rapeseed Recommending Committee (WCCRRC). Plots were harvested Sept. 9 (107 days after planting) and canola seed yields were adjusted to 10% moisture.

RESULTS: The 0.125 kg/ha rate of ICIA 5504 resulted in non-significant improvement in blackleg control compared to the 0.100 kg/ha rate when applied without surfactant. Addition of the surfactant improved blackleg control at both rates of ICIA 5504. ICIA 5504 treatments (both rates) with surfactant resulted in significantly lower blackleg rating. Fungicide treatments with surfactant were slightly better than treatments without surfactant in controlling blackleg. Differences were significant only for the low rate of ICIA 5504.

CONCLUSIONS: The fungicide ICIA 5504, when used with the surfactant (Bond), reduced the severity of blackleg infection and resulted in slight but insignificant yield increases compared to the untreated check.

Table 1. Effects of ICIA 5504 on blackleg control in canola

Treatment	Rate Kg ai/ha	Blackleg 0-5*	Canola yield Kg seed/ha
1. Untreated check	---	3.20a	1516a
2. ICIA 5504	0.100	3.14a	1697a
3. ICIA 5504 + Bond	0.100 + 0.1125	2.39b	1641a
4. ICIA 5504	0.125	2.76ab	1783a
5. ICIA 5504 + Bond	0.125 + 0.1125	2.51b	1754a

* Western Canada Canola and Rapeseed Recommending Committee scale. Means followed by the same letter do not differ significantly (P=.05,LSD)

PMR REPORT # 124 **SECTION J: CEREAL, FORAGE AND OILSEED CROPS**
STUDY DATA BASE: 303-1212-9301

CROP: Oats, cv. Nova
PEST: Speckled leaf spot, *Leptosphaera avenae f. sp. avenae*

NAME AND AGENCY:
JOHNSTON, H. W.
AAFC, Research Center, Box 1210, Charlottetown, Prince Edward Island, C1A 7M8
Tel: (902) 566-6863 **Fax**: (902) 566-6865 **Email**: johnstonw@em.agr.ca

TITLE: EFFICACY OF SEED APPLIED FUNGICIDES ON SPRING OATS, 1996.

MATERIALS: VITAFLO 250 (carbathiin, 282 g ai/L), VITAFLO 280 (carbathiin, 167 g ai/L + thiram, 148 g ai/L), BAYTAN (triadimenol, 317 g ai/L), TF 3794 (paclobutrazol, 2ME), PROSEED (hexaconazole, 250 EC)

METHODS: Pedigreed seed was treated with the above materials at rates listed below usin a rotary batch type laboratory treater. Field plots were subsequently established on 28 May at the Harrington Research Farm using 4 replicates, each plot being 2 x 5 m in size and arranged in a randomized complete block. Each 8 row plot was separated from adjacen plots by 2 rows of winter wheat. Emergence was counted on 1 m of two center rows at ZGS (Zadoks Growth Stage) 10 and foliar disease symptoms were rated for severity at ZGS 65 using a scale of 1-9 where 1 was complete health and 9 severe disease with more than 75 of the flag leaf covered with lesions of speckled leaf blotch. Yield data were determined from the harvest of the 6 oat rows in each plot using a Hege plot combine an reported at 14% moisture content.

RESULTS: See table 1 below

CONCLUSIONS: Growing conditions were good for oats in 1996 and foliar diseases did not develop to significant levels. None of the treatments significantly affected measured performance characteristis including grain yield.

Table 1. Influence of fungicide seed treatments on spring oats.

CHECK

Fungicide	Rate*	Emergence	Foliar disease**	Grain yield (kg/ha)
	Nil	429	2.5	5398
VITAFLO 250	0.8 a.i	438	2.8	5295
VITAFLO 280	3.3 ml pr	438	2.5	5141
BAYTAN	0.15 a.i.	408	2.0	5411
TF 3794	0.25 a.i.	406	2.3	5067
PROSEED	3.0 ml pr	388	2.0	5311
	LSD (0.05)	ns	ns	ns

* g per kg seed; ** 1-9, 1 healthy, 9 severe disease on upper leaves.

PMR REPORT # 125 **SECTION J: CEREAL, FORAGE AND OILSEED CROPS**
STUDY DATA BASE: 303-1212-9301

CROP: Spring wheat, cvs. Belvedere and Roblin
PEST: Powdery mildew, *Erysiphe graminis f. sp. tritici*
Leaf and glume blotch, *Leptosphaeria nodorum*
Head blight, *Fusarium graminearum and other spp.*
Seedling blights, various fungi including *Fusarium* and *Bipolaris* spp.

NAME AND AGENCY:
JOHNSTON, H. W.
AAFC, Research Center, Box 1210, Charlottetown, PEI, Canada, C1A 7M8
Tel:(902) 566-6863 **Fax:** (902) 566-6821 **Email:** johnstonw@em.agr.ca

TITLE: **EFFICACY OF FOLIAR AND SEED APPLIED FUNGICIDES AGAINST SPRING WHEAT FUNGAL DISEASES, 1996**

MATERIALS: SEED TREATMENTS: VITAFLO 250 (carbathiin, 282 g ai/L), VITAFLO 280 (carbathiin, 167 g ai/L + thiram 148 g ai/L), BAYTAN (triadimenol, 317 g ai/L), TF 3794 (paclobutrazol, 2ME), PROSEED (hexacolazole, 0.5%)
FOLIAR TREATMENTS: IB17421 (10EC, acetimide), BRAVO (chlorothalonil, 500 g ai/L), TILT (propiconazole, 250 EC).

METHODS: Pedigreed seed was treated with the seed applied fungicides in a laboratory rotary batch treater at rates indicated in the table below. Plots were planted on 28 May 1996 at the Harrington Research Farm and fertilized with 50 kg N/ha applied at 17-17-17. The foliar test plots received an additional 40 kg N/ha at ZGS 39 with commercial ammomiun nitrate. Each seed treatment plot, 2 x 5 m, was separated by 2 rows of winter wheat as a guard strip and replicated 4 times in a randomized complete block design. Foliar treatments were applied to a block of Belvedere wheat and treatments arranged in a RCB with 4 replicates. Treated foliar plots were separated by an equal sized untreated guard strip. BRAVO and TILT were applied at ZGS 37-39 while IB17421 was applied at ZGS 37, 51 and 59. Emergence was determined on 1 m of each of the center two rows in the seed treatment trial. Foliar disease severity in seed treatment trial was determined at ZGS 35 using a 1 - 9 scale, where 1 represent complete health and 9 the upper leaves with more than 75% surface area lesioned by disease. Disease severity in the foliar applied trial was determined at ZGS 65 using the same scale and head disease severity (scab) at ZGS 72 as percentage of heads with symptoms. Yield determinations were made at maturity using a Hege plot combine and all yield data reported on a 14% moisture basis.

RESULTS: see tables below.

CONCLUSIONS: The two cultivars utilized in the seed treatment trial were significantly different in characteristics assessed. Seed treatments did not change emergence, or foliar disease severity (powdery mildew and septoria leaf blotch). Yield of Belvedere wheat was improved by VITAFLO 250 but not by any other seed treatment. Grain yield of cv. Roblin was improved by BAYTAN which probably reflects the greater susceptibility to powdery mildew of this cultivar than Belvedere. The application of foliar fungicides to Belvedere spring wheat did not significantly change disease severity or grain yield.

Table 1. Response of Belvedere and Roblin spring wheat to application of fungicide seed treatments.

Treatments	Rate g ai/kg seed	Emergence plants/m2	Foliar disease (1-9)		Grain yield kg/ha
			Mildew	Septoria	
A. Belvedere					
CHECK	Nil	302a*	1.3a	3.0a	4915bc
VITAFLO 250	0.8 g ai	352a	1.5a	2.3a	5293a
VITAFLO 280	3.3 ml pr	359a	1.5a	2.3a	4730c
BAYTAN	0.15 g ai	335a	1.0a	2.5a	5031b
TF 3974	0.10 g ai	279a	1.3a	3.3a	4735c
PROSEED	3.0 ml pr	325a	2.0a	3.5a	4916bc
B. Roblin					
CHECK	Nil	400a	6.5a	6.0a	2692bc
VITAFLO 250	0.8 g ai	382a	6.8a	6.3a	2732bc
VITAFLO 280	3.3 ml pr	397a	6.8a	5.5a	2626c
BAYTAN	0.15 g ai	393a	4.0a	5.3a	3057a
TF 3974	0.10 g ai	366a	6.5a	5.8a	2693bc
PROSEED	3.0 ml pr	430a	7.0a	6.0a	2854b

* Values by column for each cultivar followed by the same letter are not significantly different, P=0.05.

Table 2. Response of Belvedere spring wheat to foliar fungicide applications.

Treatments	Rate g ai/ha	Foliar disease severity*		Head blight %	Grain yield kg/ha
		Mildew	Septoria		
CHECK	Nil	1.0a**	3.5a	0.1a	4795a
BRAVO	1000	1.0a	4.0a	0.1a	4588a
TILT	125	1.0a	3.8a	0.1a	4471a
IB17421	3.0 L pr***	1.0a	3.5a	0.0a	4457a

* 1-9, 1 healthy, 9 severe lesioning on top leaves

** Letters in each column followed by the same letter are not significantly different, P=0.05.

*** L of product

PMR REPORT # 126 **SECTION J:** **CEREAL, FORAGE, AND OILSEED CROPS**
ICAR: 61006537

CROP: Spring wheat, cv. Roblin
PEST: Powdery mildew, *Erysiphe graminis* f. sp. *tritici*

NAME AND AGENCY:
SCHAAFSMA A W
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1624 **Fax**: (519) 674-1600
MOYES T
Gustafson, A Business Unit of Uniroyal Chemical, Elmira, Ontario, N3B 3A3
Tel: (519) 669-1671 **Fax**: (519) 669-1924

TITLE: SEED TREATMENTS TO CONTROL POWDERY MILDEW IN SPRING WHEAT

MATERIALS: BAYTAN 30 (UBI 2381-1 triadimenol 317 g a.i./L); VITAFLO 280 (UBI 2051-1 carbathiin + thiram, 167 and 148 g a.i./L)

METHODS: Seed was treated on 17 April 1996 in a mini rotostat seed treater in batches of 400 g. The crop was planted on 1 May 1996 at Huron Park, Ontario using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. Powdery mildew infections were estimated as percentage of the area of each leaf covered with lesions for the same leaf taken from 10 plants at random out of the centre two rows of each plot. Plots were trimmed back to 4 m before harvest. Yields were taken on 20 August and corrected to 14 % moisture.

RESULTS: As presented in Table 1.

CONCLUSIONS: BAYTAN 30 applied as a seed treatment on spring wheat gave almost season long control of powdery mildew. However protection from BAYTAN 30 seed treatment appeared to break down as the crop matured after the flag leaf stage. This result may explain why no significant differences were noted in yields. BAYTAN 30 alone or in combination with VITAFLO 280 or water did not affect emergence.

Table 1. Effect of seed treatment on powdery mildew in spring wheat. Ridgetown, Ontario 1996.

Paramater		Emergence	Percent powdery mildew				Yield
Date Sampled		28 May	19 June	28 June	4 July	24 July	20 Aug
Crop Stage	Rate	3 leaf	6 Leaf	Boot	Flower	Late milk	mature
Part sampled	ml/kg	plant/m	2nd leaf	3rd leaf	flag leaf	flag leaf	T/ha
Non-treated	Nil	85.3 a*	21.1 a	24.5 a	8.2 a	54.7 a	1.98 a
Vitaflo 280	3.3	93.5 a	16.1 a	22.8 a	8.1 a	49.3 ab	1.96 a
Baytan 30	0.5	82.3 a	0.0 b	1.7 b	1.6 b	15.6 b	2.29 a
+ Water	3.5						
Vitaflo 280	3.3	85.0 a	0.4 b	0.8 b	2.6 ab	22.4 ab	2.24 a
+ Baytan 30	0.5						
+ Water	3.5						
CV % =		24.6	31.4	58.3	54.6	45.9	14.7

* Means followed by same letter do not significantly differ (P = .05, Duncan's MRT).

PMR REPORT # 127 SECTION J: CEREAL, FORAGE AND SPECIAL CROPS

CROP: Winter wheat, cv. Norstar
PEST: Dwarf bunt, *Tilletia controversa* Kuhn

NAME AND AGENCY:

JESPERSON G D and LASHUK L
BC Ministry of Agriculture, Fisheries and Food
200-1690 Powick Road, Kelowna, British Columbia V1X 7G5
Tel: (250) 861-7211 **Fax:** (250) 861-7490 **E-mail:** gjesperson@galaxy.gov.bc.ca

TITLE: **EFFECT OF SEED TREATMENTS ON CONTROL OF SOIL-BORNE DWARF BUNT AND EMERGENCE OF WINTER WHEAT, 1996**

MATERIALS: MERTECT FLOWABLE (thiabendazole 450 g/L), DIVIDEND 3FS (difenconazole 360 g/L), BAYTAN (triadimenol 60 g/L), RPA 400727 (triticonazole 25g/L), RAXIL (tebuconazole 9.5%), UBI 2643 (thiabendazole 317 g/L), EN63 (*Bacillus subtilis*), 1100-1 (*Pseudomonas syringae*), B8(*Enterobacter aerogenes*).

METHODS: Seed was treated with MERTECT in a 200 mL glass jar on Sept. 15, 1995. Bacterial treatments EN63, 1100-1 and B8 were supplied by Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, and were applied by soaking seed in bacterial suspensions (> 10^{10} CFU/mL, O.D.=2.4), using milk powder as a sticker. Other fungicides were applied by the manufacturers. Plots were seeded using a one-row cone seeder on Oct. 3, 1995 at Armstrong BC in soil naturally infested with dwarf bunt. The trial consisted of 11 treatments, replicated four times in a randomized complete block design. Each plot consisted of 2-6 m rows, 23 cm apart. Each row was seeded with 18 g seed. Plots were separated by a row of untreated winter barley. Emergence was assessed on Oct. 23, 1995. Supplemental inoculum was applied on Nov. 9, 1995. Inoculum was prepared by grinding dwarf bunt infected wheat heads, collected at Armstrong BC in July 1993. The ground wheat heads were mixed with sand, which was sprinkled by hand over the plot area. Five metres of each plot was harvested on August 6, 1996 using a 2-row binder. Percent bunt infection was determined by counting the number of healthy and bunted wheat spikes per plot.

RESULTS: Percent bunt infection and emergence are summarized in Table 1. There were no significant differences in emergence between treatments.

CONCLUSIONS: DIVIDEND provided almost complete suppression of dwarf bunt, and was the only treatment providing a commercially acceptable level of control. UBI 2643 (thiabendazole) also provided significant control compared to the check. MERTECT and BAYTAN appeared to provide some suppression, although it was not statistically significant.

Table 1. Percent dwarf bunt infection and emergence counts by treatment.

Treatment	Rate (g a.i./kg seed)	% Spikes with Bunt	Emergence (plants/m)
Check	---	11.1 abc*	81 a*
RAXIL	0.05 g	16.2 a	72 a
EN63	---	12.6 abc	78 a
1100-1	---	12.2 abc	78 a
B8	---	10.4 abcd	87 a
727	0.15 g	14.8 ab	78 a
727	0.30 g	10.0 bcd	92 a
BAYTAN	0.5 g	6.8 cd	82 a
MERTECT	4.0 g	6.9 cd	72 a
UBI 2643	3.0 g	4.6 de	83 a
DIVIDEND	0.12 g	0.03 e	88 a

* Numbers followed by the same letter are not significantly different according to Least Significant Difference Test (P=0.05)

PMR REPORT # 128 **SECTION J:** **CEREAL, FORAGE, AND OILSEED CROPS**
ICAR: 61006537

CROP: Winter wheat cv. unknown
PEST: Loose smut, *Ustilago tritici*

NAME AND AGENCY:
SCHAAFSMA A W
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1624 **Fax**: (519) 674-1600
MOYES T
Gustafson, A Business Unit of Uniroyal Chemical, Elmira, Ontario, N3B 3A3
Tel: (519) 669-1671 **Fax**: (519) 669-1924

TITLE: **SEED TREATMENTS TO CONTROL LOOSE SMUT IN WINTER WHEAT**

MATERIALS: BAYTAN 30 (UBI 2381-1 triadimenol 317 g a.i./L); RAXIL (UBI 2584-3 tebuconazole 8.33 g a.i./L; VITAFLO 280 (UBI 2051-1 carbathiin + thiram, 167 and 148 g a.i./L)

METHODS: Seed known to be infected with loose smut was treated on 2 October, 1995 in plastic bags in batches of 500 g. The crop was planted on 12 October, 1995 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. The total number of heads showing smut infection were counted after anthesis (4 July,

1996) for each plot, and these were expressed as a percentage of the total number of heads for each plot. Yields were taken on 14 August and corrected to 14 % moisture.

RESULTS: As presented in Table 1.

CONCLUSIONS: The lower rate of UBI 2051-1 provided the same measure of control as the higher rate. However, both of these treatments were not as effective as those which contained triadimenol or tebuconazole. Treatments containing triadimenol or tebuconazole resulted in 100% control of loose smut. There was no yield penalty with the use of any of the seed treatments. The levels of smut were too low to result in any significant yield advantage with seed treatment use.

Table 1. Effect of seed treatment on loose smut in winter wheat. Ridgetown, Ontario 1996.

	Treatment	Rate (ml/kg seed)	% smutted heads	Yield T/ha
1	NON-TREATED		1.49 a*	2.53 a
2	UBI 2051-1	2.3	0.11 b	2.59 a
3	UBI 2051-1	3.3	0.15 b	2.53 a
4	UBI 2383-1	0.94	0.00 c	2.62 a
	WATER	4.06		
5	UBI 2051-1	2.3	0.00 c	2.69 a
	UBI 2383-1	0.94		
	WATER	4.06		
6	UBI 2584-3	1.8	0.00 c	2.32 a
7	UBI 2584-3	2.4	0.00 c	2.77 a
	CV % =		23.50	9.04

* Means followed by same letter do not significantly differ (P = .05, Duncan's MRT).

PMR REPORT # 129 **SECTION J: CEREAL, FORAGE, AND OILSEED CROPS**
ICAR: 61006537

CROP: Winter wheat cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

NAME AND AGENCY:
SCHAAFSMA A W
Ridgetown College of Agricultural Technology, Ridgetown, Ontario, N0P 2C0
Tel: (519) 674-1624 **Fax**: (519) 674-1600

TITLE: SUSCEPTIBILITY OF WINTER WHEAT CULTIVARS RECOMMENDED FOR ONTARIO TO FUSARIUM HEAD BLIGHT IN ARTIFICIALLY INOCULATED AND MISTED PLOTS COMPARED WITH NATURAL INFECTION UNDER EPIDEMIC CONDITIONS

METHODS: Artificial Inoculations: The crop was planted on 10 October, 1995 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained using provincial recommendations. Inoculations were timed according to anthesis heading for each plot. The first inoculation was

done at 50% anthesis of primary heads followed by a second inoculation 7 days later. The plots were inoculated at around 4 pm with a 100 mL suspension of macro conidia of *F. graminearum* at 30,000 spores/mL grown on liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute for 2 hr after 16:00 hr. The misters delivered about 7.5 mm of water each day. The mist system was engaged until 3 days after the last inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Twenty heads were selected at random out of each plot. Heads were placed into one of eight classes 0,5,10,15,30,50,75,100 % infected spikelets. A Fusarium index was applied to the data, which was the product of the percentage of heads infected and the percent spikelets infected. The plots were harvested on 17 July. Sixty randomly-selected seeds were surface-sterilized in 3 % NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 days, and the percent *Fusarium*-infected kernels was determined. Deoxynivalenol content was estimated using solvent extraction (Acetonitrile: 4% KCl at 9:1), clean-up on an activated charcoal column and thin layer chromatography (Silica Gel HL plates, with chloroform:methanol (94:6) as the solvent system).
Natural Infections: Under a major epidemic in southern Ontario the recommended winter wheat cultivars were evaluated at the performance tests conducted at Ridgetown, Innwood, Huron, and London. Disease evaluation at these locations was conducted similar to that done in the artificially inoculated plots.

RESULTS: The results are summarized in the following Tables.

CONCLUSIONS: Fusarium head blight (FHB) symptoms did not correlate well with tombstone counts nor deoxynivalenol (DON) contamination. Some cultivars that had very high FHB indexes had lower DON content, whereas some cultivars that had lower FBH indexes contained higher levels of DON. Tombstone counts were correlated to DON levels. Most of the cultivars tested were susceptible to FHB and DON accumulation in the seed. Whereas at first glance one might conclude that red cultivars in general had less FHB and DON, the levels were still unacceptable with the exception perhaps of Ruby, Mendon and Dynasty. It is not safe to conclude that all red cultivars of winter wheat are more tolerant to FHB. Each variety must be considered on its own merit. Of the white cultivars, Marilee was the least susceptible, but still unacceptable.

Table 1a. Fusarium head blight reaction of 24 recommended winter wheat varieties in misted and artificially inoculated plots at Ridgetown, Ontario. 1996.

			FHB index (Inc. X Sev.) 20 HEADS PER PLOT		% Kernels Infected	DON (ppm by TLC)	
		cl	Inoculat.	Natural	Inoculat.	Inoculat.	Natural
1	HARUS	w	0.06 cde*	0.27 c	0.91 abc	6.00 ab	4.50
2	REBECCA	w	0.08 b-e	0.24 c	0.93 a	11.25 ab	5.75
3	ZAVITZ	w	0.14 a-e	0.29 bc	0.93 ab	14.75 a	7.75
4	KARENA	w	0.16 a-e	0.29 bc	0.91 abc	6.75 ab	3.00
5	AC RON	w	0.25 ab	0.46 abc	0.95 a	6.00 ab	4.00
6	OAC ARISS	w	0.12 a-e	0.25 c	0.90 abc	5.75 ab	2.75
7	DELAWARE	w	0.12 a-e	0.37 abc	0.94 a	10.00 ab	3.25
8	CASEY	r	0.17 a-e	0.36 abc	0.90 abc	4.75 ab	3.38
9	RUBY	r	0.11 a-e	0.24 c	0.85 abc	2.80 b	1.68
10	FUNDULEA	r	0.04 e	0.27 c	0.91 abc	6.50 ab	3.13
11	DIANA	w	0.30 a	0.43 abc	0.92 abc	11.75 ab	8.00
12	MARILEE	w	0.09 b-e	0.30 abc	0.90 abc	3.00 b	2.63
13	FREEDOM	r	0.04 de	0.25 c	0.94 a	7.75 ab	0.98
14	AC DEXTER	w	0.25 ab	0.42 abc	0.83 abc	6.75 ab	3.30
15	AC CARTIER	w	0.19 a-d	0.39 abc	0.88 abc	4.50 ab	3.30
16	AC MORLEY	w	0.08 b-e	0.29 bc	0.77 c	2.63 b	4.55
17	P 2737	w	0.19 a-d	0.36 abc	0.88 abc	5.50 ab	4.75
18	P 2510	r	0.09 b-e	0.33 abc	0.95 a	3.75 ab	1.88
19	P XW741	w	0.09 b-e	0.46 abc	0.96 a	11.75 ab	2.50
20	HANOVER	r	0.20 abc	0.52 ab	0.96 a	10.50 ab	3.30
21	MENDON	r	0.13 a-e	0.36 abc	0.86 abc	3.00 b	0.80
22	DYNASTY	r	0.06 cde	0.24 c	0.77 bc	0.93 b	1.85
23	F93012-M3	r	0.24 abc	0.54 a	0.89 abc	8.75 ab	6.13
24	ENA	w	0.08 b-e	---	0.85 abc	5.25 ab	---
CV			26.9	26.1	3.6	66.5	44.6

* Means followed by same letter do not significantly differ (P=.05, Tukey's HSD) cl = colour where w is white and r is red

Table 1b. Analysis of variance summary for 23 winter wheat varieties in the same tests as Table 1a.

Source		df					
rep or loc	F	3	3.190	25.14	2.338	1.342	14.04
	p(F)		0.0289	0.0001	0.0811	0.2680	0.0001
Variety	F	22	4.368	4.14	2.831	2.489	1.59
	p(F)		0.0001	0.0001	0.0005	0.0019	0.0766

Table 2. Correlation of visible symptoms of fusarium head blight with levels of deoxynivalenol, Ontario. 1996.

Parameter vs. DON	Coefficient (r)
A) Misted and artificially inoculated plots at Ridgetown (N=200)	
Disease incidence	0.13 ns
Disease severity	0.30 *
Fusarium head blight index (I x S)	0.28 *
Percent kernels infected	0.34 *
B) Naturally infected plots at Ridgetown, Inwood, Huron, and London, Ontario (N=92)	
Fusarium head blight index (I X S)	0.08 ns
Percent tombstone (w/w)	0.57 *

Table 3. Analysis of variance summary for effect of winter wheat variety on fusarium head blight index, % tombstones (w/w), and levels of deoxynivalenol (ppm) in variety recommendation tests at four locations in SW Ontario under natural infection. 1996.

		FHB Index		% Tombstones		Deoxynivalenol	
Source	df	F Value	P > F	F Value	P > F	F Value	P > F
Loc	3	25.14	0.0001	28.68	0.0001	14.04	0.0001
Variety	22	4.14	0.0001	0.87	0.6276	1.59	0.0766

Table 4. Comparison of resistance to fusarium head blight in red and soft white winter wheat cultivars in artificially and naturally inoculated plots. Ontario 1996.

	Source of	Fusarium HB Index		Deoxynivalenol (ppm)	
Location	infection	Soft White	Red	Soft White	Red
Ridgetown	(natural)	0.34	0.38	1.82	0.80
London	(natural)	0.43	0.41	4.36	3.37
Innwood	(natural)	0.45	0.33	6.12	3.82
Huron	(natural)	0.19	0.23	4.77	3.07
Ridgetown	(inoculated)	0.16	0.12	7.98 a	5.14 b
Mean of all locations		0.31	0.29	5.01 a	3.24 b

END OF SECTION J

SECTION K - PLANT PATHOLOGY/PHYTOPATHOLOGIE - ORNAMENTALS, GREENHOUSE AND TURF/PLANTES ORNEMENTALES, DE SERRE ET DE GAZON

- Reports/Rapports # 130-132
- Pages # 251-259

Section Editor: **Gary Platford**

PMR REPORT # 130 **SECTION K: ORNAMENTALS, GREENHOUSE and TURF**

CROP: Bentgrass, cv. Penncross
PEST: Pythium root rot, *Pythium graminicola* Subramanian, *P. aristosporum* Vanterpool, *P. ultimum* Trow. var. *ultimum*, *P. vanterpoolii* V. Kouyeas & H. Kouyeas, *P. aphanidermatum (Edson) Fitzp.*

NAME AND AGENCY:
NG K K, AND MACDONALD L
BC Ministry of Agriculture, Fisheries & Food,
1767 Angus Campbell Road, Abbotsford, B.C. V3G 2M3
Tel: (604) 556-3001 **Fax:** (604) 556-3030 **Email:** Lmacdonald@galaxy.gov.bc.ca

TITLE: **EFFICACY OF SEED TREATMENTS AGAINST PYTHIUM DAMPING-OFF OF BENTGRASS, 1996**

MATERIALS: APRON FL (metalaxyl), THIRAM WP (thiram).

METHODS: Pythium inoculum was prepared in chopped potato sand medium that contained 10 g of chopped potato and 100 mL of top-dressing sand in a 250 mL flask. Flasks were sterilized for 1 h and seeded with three 5 mm agar plugs from a 24 h Pythium culture on potato dextrose agar. Seven species of *Pythium* were tested, *P. aphanidermatum* (Abad 1541), *P. aristosporum* (Abad 1522), *P. graminicola* (BCMAFF 92-134), *P. myriotylum* (Abad 1529), *P. torulosum* (BCMAFF 92-119), *P. ultimum* (BCMAFF 95-211), and *P. vanterpoolii* (Abad 1536). The chopped potato sand medium was incubated for 14 days at room temperature in darkness. The cultures were removed from flasks, air-dried overnight and used as inoculum. Two types of growing media were tested: clean, top-dressing sand from a golf course that was autoclaved at 121 •C for 60 minutes and unsterilized sand collected from a site where bentgrass had previously grown. PVC pipes, 6 cm in diameter and 5 cm high, with one surface covered with black landscaping mesh to hold the growing media were used as pots. Approximately 50 mL of Pythium inoculum was added to 1.5 L of planting material in polyethylene bags, shaken vigorously to ensure uniform distribution of inoculum, and distributed into pots. Each pot was seeded with approximately 0.1 g bentgrass seed treated with one of the following fungicides: 32 g metalaxyl/100 kg (APRON), 64 g metalaxyl/100 kg (2x APRON) or 32 g metalaxyl plus 270 g thiram /100 kg (APRON + THI). Untreated seed was used as a control. Pots were kept at 15 •C in a complete randomized block design with four replicates. They were evaluated for disease severity based on percent germination after 10 days with a 0-5 visual rating scale (see tables). The experiment was repeated once. Data from both trials was pooled, and a combined analysis of variance performed.

RESULTS: All three treatments provided excellent control against all *Pythium* spp. tested on bentgrass. Treated seeds and untreated seeds had good germination in the uninoculated pots of sterile sand (Table 1). *Pythium* *vanterpoolii, P. graminicola, P. aphanidermatum, P. aristosporum* and *P. ultimum* significantly reduced the percent germination of untreated bentgrass seeds. *Pythium torulosum* and *P. myriotylum* did not reduce germination in treated or untreated seeds (Table 1). The fungicides provided excellent protection against *Pythium* spp. when the same experiment was conducted using unsterilized sand (Table 2). Untreated seeds, with or without *Pythium* inoculum had either low or no germination. The increase in disease severity was likely due to the presence of pathogenic fungi in the unsterilized sand. *Pythium* spp. and a *Microdochium* sp. were isolated from the sand. The site where the unsterilized sand was obtained had a history of Pythium root rot and Fusarium patch.

CONCLUSIONS: Seeds treated with metalaxyl or metalaxyl plus thiram were protected against seven species of *Pythium*, as well as other pathogenic fungi present in unsterilized sand. It is recommended that growers use treated seeds if their soil has a history of Pythium disease or other damping-off fungi.

Table 1. The effect of APRON, and APRON + THIRAM (THI) as seed protectants against Pythium damping-off on bentgrass in sterile sand*.

Pythium sp.	APRON	APRON+THI	2x APRON	Untreated
P. aphanidermatum	1.0 a	1.0 a	1.0 a	3.0 a
P. aristosporum	1.0 a	1.0 a	1.0 a	4.2 b
P. graminicola	1.0 a	1.0 a	1.0 a	4.0 b
P. myriotylum	1.0 a	1.0 a	1.0 a	1.0 a
P. torulosum	1.0 a	1.0 a	1.0 a	1.0 a
P. ultimum	1.1 a	1.0 a	1.0 a	3.6 b
P. vanterpoolii	1.0 a	1.0 a	1.0 a	3.1 b
Uninoculated	1.0 a	1.0 a	1.0 a	1.0 a

* Disease severity based on 1=100% germination; 2>80% germination; 3=40-60% germination; 4<40 % germination, and 5=no germination. Means followed by the same letter in each row are not significantly different ($P<0.05$) according to Student-Newman-Keuls test.

Table 2. Effect of APRON, and APRON + THIRAM (THI) as seed protectants against Pythium damping-off on bentgrass in unsterilized sand*.

Pythium sp.	APRON	APRON+THI	2x APRON	Untreated
P. aphanidermatum	1.0 a	1.0 a	1.0 a	3.6 b
P. aristosporum	1.2 a	1.0 a	1.2 a	4.2 b
P. graminicola	1.0 a	1.0 a	1.0 a	5.0 b
P. myriotylum	1.2 a	1.0 a	1.2 a	3.8 b
P. torulosum	1.0 a	1.0 a	1.0 a	3.4 b
P. ultimum	1.6 b	1.0 a	1.0 a	4.0 c
P. vanterpoolii	1.1 a	1.0 a	1.0 a	3.4 b
Uninoculated	1.1 a	1.0 a	1.1 a	3.6 b

* Disease severity based on 1=100% germination; 2>80% germination; 3=40-60% germination; 4<40 % germination, and 5=no germination. Means followed by the same letter in each row are not significantly different ($P<0.05$) according to Student-Newman-Keuls test.

PMR REPORT # 131 **SECTION K: ORNAMENTALS, GREENHOUSE CROPS AND TURF**
ICAR: 93000480

CROP: Kentucky bluegrass (*Poa pratensis* L.), cvs. Asset, Barcelona, Cynthia and Midnight
PESTS: Powdery mildew, *Erysiphe graminis* DC.; Rust. *Puccinia brachypodii* G. Otth var. *poae-nemoralis* (G. Otth) Cummins & H.C. Greene

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1306; **Email:** howardr@agric.gov.ab.ca

TITLE: **EFFICACY OF TWO FUNGICIDES AGAINST POWDERY MILDEW AND RUST ON FOUR CULTIVARS OF KENTUCKY BLUEGRASS AT BROOKS, ALBERTA, IN 1996**

MATERIALS: TILT 250 E (propiconazole 250 g/L EC), NOVA 40 W (myclobutanil 40% WP), COMPANION AGRICULTURAL ADJUVANT (octlphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: Fungicide efficacy trials were conducted in experimental plots of Kentucky bluegrass grown for seed at CDC South. The four cultivars used in this study were chosen on the basis of their disease reaction in previous trials at Brooks, i.e. Asset - mildew and rust susceptible; Barcelona - mildew susceptible and rust resistant; Cynthia - mildew resistant and rust susceptible; Midnight - mildew and rust susceptible. Each fungicide treatment (see Tables 1-4) was applied to six, 5 m^2 subplots. A similar set of subplots was sprayed with tap water as an untreated check. COMPANION, a non-ionic adjuvant, was added to the spray mixes containing NOVA 40 W at the rate of 1.0 mL/L of mixture. The treatments were arranged in a randomized complete block design with six replications. The spray solutions were applied over the top of the plant canopy with a CO_2-propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The grass was 15-20 cm tall and not yet headed out on May 24 when all of the "Early (E)" treatments (nos. 1, 2, 4, 5, 6, 8), as well as the check, were applied for the first time. The equivalent of 200 L/ha of spray mixture was sprayed onto each subplot using a boom pressure of 275 kPa. A trace amount of mildew was noticed in all four cultivars at this time, but no rust was seen. On June 13, a second round of spraying for the "Late (L)" treatments (nos. 3, 4, 7, 8) was done when 50-100% of the plants were in head. Asset, Barcelona and Cynthia were showing light to moderate mildew infection and Midnight a heavy infection on this date, but no rust symptoms were observed.

On July 8-12, random samples of 100 leaves were collected from each treatment subplot for all four cultivars and were visually rated for mildew and rust incidence (% leaves infected) and severity (% leaf area diseased), i.e. clean (0) = no mildew/rust; slight (1) = 1-5%, moderate (2) = 6-25%, and severe (3) = >25%. Disease severity indexes were calculated for each subplot using the following formula: [(1 x no. slightly affected leaves) + (2 x no. moderately affected leaves) + (3 x no. severely affected leaves)] ÷ 100; maximum severity rating = 3.0. When the heads were mature, 3.3 m^2 of crop was harvested from each subplot, dried and threshed. Seed cleaning and weighing are pending. Disease incidence and severity data were subjected to analysis of variance (ANOVA). Disease incidence (%) values were arcsin transformed prior to ANOVA.

RESULTS:

Midnight - Moderately high amounts of mildew and rust occurred in this cultivar (Table 1). All eight fungicide treatments significantly (P•0.05) reduced mildew incidence and severity relative to the check, with NOVA 40 W (E+L) appearing to perform the best. TILT 250 E (E+L), NOVA 40 W (E) at 0.5 kg/ha, and TILT 250 E (E) at 1.0 L/ha also worked reasonably well in keeping mildew incidence and severity low. All treatments, except TILT 250 E (L) and NOVA 40 W (L), significantly reduced the incidence and severity of rust relative to the check.

Cynthia - Mildew and rust levels were moderately high (Table 2). All of the fungicide treatments had significantly (P•0.05) less mildew than the check, but the amount of rust was not significantly reduced by the application of these chemicals.

Asset - The extent of mildew and rust infection in Asset subplots was relatively low compared to the other cultivars in this trial (Tables 1-4). TILT 250 E (E+L), NOVA 40 W (E), and NOVA 40 W (E+L) significantly (P•0.05) reduced both the incidence and severity of powdery mildew (Table 3). TILT 250 E (E+L) and NOVA 40 W (E+L) provided the best control of rust in terms of lowering disease incidence; however, none of the products under test significantly reduced the severity of this disease relative to the check.

Barcelona - Mildew and rust levels in this cultivar were moderately high (Table 4), but generally less than in Midnight and Asset (Tables 1-2). All of the fungicide-treated subplots had significantly (P•0.05) less mildew than the check (Table 4). The NOVA 40 W (E+L) and TILT 250 E (E+L) plots exhibited the lowest incidence and severity of mildew. Subplots sprayed with NOVA 40 W (E+L) had the lowest incidence and severity ratings for rust, but this treatment was not significantly better than some of the others under test.

CONCLUSIONS: Adequate levels of disease occurred in most of the cultivars to provide meaningful efficacy tests. In many cases, the best control of mildew and rust was achieved by applying NOVA 40 W or TILT 250 E twice. There was also a trend for single sprays to be more effective if applied early (E) rather than late (L). In addition, the heavier rates of fungicide application generally outperformed the lighter ones. Both fungicides showed considerable promise as tools for the successful management of powdery mildew and rust in bluegrass seed crops under field conditions in southern Alberta.

Table 1. Incidence and severity of powdery mildew and rust on Midnight bluegrass treated with two fungicides in field plots at Brooks, Alberta, in 1996.*

	Rate of product /ha	Incidence (%)**		Severity (0-3)	
Treatment***		Mildew	Rust	Mildew	Rust
1 TILT 250 E (E)	0.5 L	18.8 a	10.6 c	0.2 ab	0.2 c
2 TILT 250 E (E)	1.0 L	7.8 abc	13.7 c	0.1 ab	0.2 c
3 TILT 250 E (L)	1.0 L	27.2 a	54.8 a	0.5 a	1.1 a
4 TILT 250 E (E+L)	0.5 L	0.4 bc	26.6 bc	0.0 b	0.3 bc
5 NOVA 40 W (E)	0.25 kg	13.8 ab	20.7 c	0.2 ab	0.3 bc
6 NOVA 40 W (E)	0.5 kg	6.6 abc	13.4 a	0.1 ab	0.2 c
7 NOVA 40 W (L)	0.5 kg	17.8 a	48.5 ab	0.4 ab	0.8 ab
8 NOVA 40 W (E+L)	0.25 kg	0.0 c	10.7 c	0.0 b	0.2 c
9 Untreated check	-	71.4 d	62.6 a	1.2 c	1.0 a
ANOVA P•0.05	-	s	s	s	s
Coefficient of Variation (%)		65.6	35.9	107.6	86.6

* Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P•0.05).

** Disease incidence data were arcsin transformed prior to analysis of variance and the detransformed means are presented here.

*** E = early application (May 24); L = late application (June 13).

Table 2. Incidence and severity of powdery mildew and rust on Cynthia bluegrass treated with two fungicides in field plots at Brooks, Alberta, in 1996.*

	Rate of product /ha	Incidence (%)**		Severity (0-3)	
Treatment***		Mildew	Rust	Mildew	Rust
1 TILT 250 E (E)	0.5 L	5.7 b	39.1	0.1 b	0.4
2 TILT 250 E (E)	1.0 L	3.0 b	44.8	0.1 b	0.5
3 TILT 250 E (L)	1.0 L	7.0 b	45.5	0.2 b	0.5
4 TILT 250 E (E+L)	0.5 L	0.3 b	31.2	0.0 b	0.4
5 NOVA 40 W (E)	0.25 kg	0.3 b	51.8	0.0 b	0.6
6 NOVA 40 W (E)	0.5 kg	0.1 b	50.3	0.0 b	0.6
7 NOVA 40 W (L)	0.5 kg	7.1 b	59.4	0.2 b	0.7
8 NOVA 40 W (E+L)	0.25 kg	1.7 b	47.0	0.0 b	0.5
9 Untreated check	-	46.2 a	65.4	0.6 a	0.8
ANOVA P•0.05	-	s	ns	s	ns
Coefficient of Variation (%)		83.5	26.1	129.5	43.3

* Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P•0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

*** E = early application (May 24); L = late application (June 13).

Table 3. Incidence and severity of powdery mildew and rust on Asset bluegrass treated with two fungicides in field plots at Brooks, Alberta, in 1996.*

Treatment***	Rate of product /ha	Incidence (%)** Mildew	Incidence (%)** Rust	Severity (0-3) Mildew	Severity (0-3) Rust
1 TILT 250 E (E)	0.5 L	4.4 abc	24.3 a	0.1 abc	0.3
2 TILT 250 E (E)	1.0 L	1.6 abc	13.7 abc	0.1 bc	0.2
3 TILT 250 E (L)	1.0 L	5.4 ab	14.6 abc	0.1 ab	0.2
4 TILT 250 E (E+L)	0.5 L	0.0 c	4.9 bc	0.0 c	0.1
5 NOVA 40 W (E)	0.25 kg	0.0 c	11.9 abc	0.0 c	0.3
6 NOVA 40 W (E)	0.5 kg	0.1 bc	20.1 ab	0.0 c	0.2
7 NOVA 40 W (L)	0.5 kg	1.3 abc	19.9 ab	0.0 bc	0.2
8 NOVA 40 W (E+L)	0.25 kg	0.0 c	2.0 c	0.0 c	0.0
9 Untreated Check	-	10.4 a	21.6 ab	0.2 a	0.2
ANOVA P•0.05	-	s	s	s	ns
Coefficient of Variation (%)		140.1	52.6	176.7	86.5

* Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P•0.05).

** Disease incidence data were arcsin transformed prior to analysis of variance and the detransformed means are presented here.

*** E = early application (May 24); L = late application (June 13).

Table 4. Incidence and severity of powdery mildew and rust on Barcelona bluegrass treated with two fungicides in field plots at Brooks, Alberta, in 1996.*

Treatment***	Rate of product /ha	Incidence (%)** Mildew	Incidence (%)** Rust	Severity (0-3) Mildew	Severity (0-3) Rust
1 TILT 250 E (E)	0.5 L	11.4 d	24.0 b	0.2 b	0.3 bc
2 TILT 250 E (E)	1.0 L	6.0 cd	26.2 ab	0.1 b	0.3 bc
3 TILT 250 E (L)	1.0 L	10.5 d	29.1 ab	0.2 b	0.4 b
4 TILT 250 E (E+L)	0.5 L	0.2 b	29.4 ab	0.0 b	0.4 b
5 NOVA 40 W (E)	0.25 kg	5.4 bcd	21.8 bc	0.1 b	0.2 bc
6 NOVA 40 W (E)	0.5 kg	0.3 bc	21.0 bc	0.0 b	0.2 bc
7 NOVA 40 W (L)	0.5 kg	3.8 bcd	32.5 ab	0.1 b	0.4 ab
8 NOVA 40 W (E+L)	0.25 kg	0.1 b	9.8 c	0.0 b	0.1 c
9 Untreated check	-	48.6 a	43.5 a	0.6 a	0.6 a
ANOVA P•0.05	-	s	s	s	s
Coefficient of Variation (%)		61.4	26.6	115.8	49.2

* Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P•0.05).

** Disease incidence data were arcsin transformed prior to analysis of variance and the detransformed means are presented here.

*** E = early application (May 24); L = late application (June 13).

PMR REPORT # 132 **SECTION K:** **ORNAMENTALS, GREENHOUSE CROPS AND TURF**
ICAR: 93000480

CROP: Kentucky bluegrass(*Poa pratensis* L.), cvs. Asset, Barcelona, Cynthia, Midnight and Abbey
PEST: Silvertop, *Fusarium* spp. and various insects

TITLE: EFFECTS OF RESIDUE REMOVAL AND CULTIVAR ON THE INCIDENCE OF SILVERTOP IN KENTUCKY BLUEGRASS AT BROOKS, ALBERTA, IN 1995-96

NAME AND AGENCY:
HOWARD R J, CHANG K F, BRIANT M A, MADSEN B M and GRAHAM S G
Alberta Agriculture, Food and Rural Development
Crop Diversification Centre, South, SS 4, Brooks, Alberta T1R 1E6
Tel: (403) 362-1328; **Fax:** (403) 362-1306; **Email:** howardr@agric.gov.ab.ca

MATERIALS: None

METHODS: These trials were conducted in established Kentucky bluegrass research plots at CDC South. The cultivar Abbey, which was used in residue removal studies, was planted in 1993, while the plots of Asset, Cynthia, Barcelona and Midnight used for cultivar susceptibility trials were seeded in 1994.
Residue Removal Trials - This study was comprised of three treatments: 1) burning residual foliage, 2) clipping and removing residual foliage, and 3) leaving residual foliage intact [untreated check]. The treatments were arranged in a randomized complete block design with four replications. Each subplot was 18 m^2 in size. Treatment 1 consisted of burning the plots after seed harvest. This was done on August 19/94 and August 3/95 with the aid of tractor-drawn propane burner. Treatment 2 involved mowing and raking off the residual foliage. In treatment 3, the residual foliage was left intact. The plots were examined for silvertop on August 7/95 and July 16/96. The number of healthy panicles, as well as those with silvertop symptoms, were counted and recorded from a 1 m^2 sample area from each subplot. The percentage of silvertop panicles/m^2 was determined and the data were log transformed and subjected to ANOVA.
Cultivar Susceptibility Trials - Asset, Barcelona, Cynthia and Midnight were each seeded in a 432 m^2 plot. A 1 m^2 quadrat from the four corners plus the center of each plot was hand harvested once a week from June 9-30, 1995, and from June 14 - July 4, 1996. The number of silvertop-affected panicles were counted and the data were processed as described above for the residue removal trials.

RESULTS:
Residue Removal Trials - In 1995, there was significantly (P•0.05) less silvertop in the burned plots compared to the check (Table 1). The clip and remove treatment also had a lower percentage of affected panicles relative to the check, but this difference was not statistically significant. In 1996, once again, both of the residue removal treatments had less silvertop than the check, but these differences were not significantly different. This may have been due, in part, to large fluctuations in silvertop incidence between replicates on some dates.
Cultivar Susceptibility Trials - The incidence of silvertop showed a steady increase in all four cultivars during the assessment period in both years (Tables 2 & 3). In 1995, there were no significant (P•0.05) differences in incidence between the four cultivars on June 9; however, Barcelona clearly had

more diseased plants than Midnight, Cynthia and Asset (Table 2). This trend continued over the next two assessment dates, June 16 and 23; however, by June 30, disease levels in Cynthia were significantly higher than in the other cultivars under test, including Barcelona. The relative incidence of silvertop amongst cultivars in 1996 differed from that seen in 1995. On the earliest assessment date in 1996 (June 14), silvertop was more prevalent in Cynthia than in the other three cultivars, but it only differed significantly from Midnight, which had the lowest level of disease (Table 3). On subsequent dates, Cynthia almost invariably had the largest number of diseased panicles. By July 4, Asset and Barcelona clearly had the lowest levels of silvertop compared to Midnight and Cynthia.

CONCLUSIONS: Burning or clipping and removing residual foliage after harvest reduced the incidence of silvertop in grass seed crops the following season. Over a two-year trial period, Asset appeared to be less susceptible to silvertop than Barcelona, Midnight and Cynthia.

Table 1. Percent silvertop panicles in Abbey bluegrass plots receiving three residue management treatments at Brooks, Alberta in 1996.

	% silvertop panicles	
Treatment	1995	1996*
Control	33.9 a	57.6
Clip and Remove	22.4 ab	51.5
Burn	11.2 b	33.2
ANOVA P• 0.05	5	ns
Coefficient of Variation (%)	18.6	25.2

* Disease incidence values were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 2. Number of silvertop panicles in four grass cultivars examined from June 9-30, 1995, in field plots at Brooks, Alberta.

	Average number of silvertop panicles/5 m^2*			
Treatment	June 9	June 16	June 23	June 30
Midnight	0.0 b	6.9 b	46.9 bc	99.0 b
Cynthia	1.8 ab	5.0 b	94.5 ab	250.2 a
Asset	1.6 ab	6.9 b	23.0 c	49.1 c
Barcelona	4.3 a	24.1 a	119.2 a	137.0 b
ANOVA P• 0.05	ns	s	s	s
Coefficient of Variation %	51.6	23.5	14.1	9.0

* Data were log transformed prior to analysis prior to analysis of variance and the detransformed means are present here.

Table 3. Number of silvertop panicles in four grass cultivars examined from June 14 - July 4, 1996, in field plots at Brooks, Alberta.

	Average number of silvertop panicles/5 m^2*			
Treatment	June 14	June 21	June 28	July 4
Midnight	1.0 b	42.7 b	130.8 b	1147.2 a
Cynthia	12.5 a	217.8 a	500.2 a	1512.6 a
Asset	8.5 a	26.5 b	35.3 c	157.5 b
Barcelona	7.5 a	62.1 b	137.0 b	415.9 b
ANOVA P•0.05	s	s	s	s
Coefficient of Variation %	22.5	20.41	14.02	11.48

* Data were log transformed prior to analysis prior to analysis of variance and the detransformed means are present here.

END OF SECTION K

SECTION L - NEMATODES/NÉMATODES

- Report/Rapport # 133
- Page # 260-261

Section Editor: **John W. Potter**

PMR REPORT # 133 **SECTION L: NEMATODES**

CROP: Peach (*Prunus persica*)
PEST: *Pratylenchus penetrans* Cobb

NAME AND AGENCY:
MCFADDEN-SMITH W and MILES N
Horticultural Research Institute of Ontario,
Box 7000, Vineland Station, Ontario L0R 2E0
Tel: (905) 562-4141 **Fax**: (905) 562-3413 **Email**: mcfaddw@gov.on.ca
POTTER J W
Agriculture and Agri-Food Canada, Pest Management Research Centre
Box 6000, Vineland Station, Ontario L0R 2E0
Tel: (905) 562-4113 **Fax**: (905) 562-4335

TITLE: **EVALUATION OF PEACH ROOTSTOCKS FOR RESISTANCE/TOLERANCE TO ROOT LESION NEMATODE (PRATYLENCHUS PENETRANS), 1995 and 1996**

METHODS: Bailey, Chui Lum Tao, Tzim Pee Tao, H7338013, H7338019, GF 305, Higama, Montclar, BY520-8 and BY520-9 rootstocks were included in a greenhouse study in 1995 and 1996. With the exception of Bailey, seeds were removed from pits in December, soaked in thiram and placed in moistened perlite in plastic bags and placed in a seed germinator at 4C for stratification. Bailey seeds were treated the same way except they were left in the pits. Seeds were planted over a 4-week period at weekly intervals into a sterilized medium in root trainer pots starting in mid-January. Once plants reached a height of 20 cm, 5 seedlings of each rootstock were planted into nematode-infested (2500 nematodes per kg soil in 1995 and 6000 in 1996) and 5 into nematode-free (steam sterilized) soil. Four plantings were done at weekly intervals to provide 4 replicates in time. Five pairs (nematode-free and nematode infested) of each rootstock were planted at each planting date in a randomized complete block design. Trunk cross-sectional area and plant height were measured at each planting date in 1995 and 1996, and weekly until the termination of the experiment at 14 weeks in 1995 only. At harvest, ten leaves were collected from each plant. Leaf area and nutrient content were determined. Trunk cross-sectional area, plant height, and fresh and dry weights of tops (separated into leaves, shoots and trunk) and roots (separated into coarse and fine roots) were determined. The Baermann pan method was used to extract nematodes from roots and soil. Data were analyzed using the SAS statistical package.

RESULTS: Due to limited resources in 1995, initial nematode counts were done only on the bulk nematode-infested soil rather than on individual pots. In the 1995 trial, there were significantly more nematodes per kg soil in pots of BY520-9 than in SL2243, Higama, Tzim Pee Tao, Bailey and Chui Lum Tao and fewer in Chui Lum Tao than all the other rootstocks. There were no statistical differences among the rootstocks with respect to the number of nematodes per gram of fine root. No consistent differences could be detected among rootstocks with respect to visual rating, leaf area, or dry weight of leaves, shoots, trunks or roots. Plant vigor was exceptional (height of over 1 m in most cases at the end of the experiment). It is possible that growing conditions for the plants were not sufficiently stressful to allow the true effects of the nematodes to be expressed in 1995. The experiment was repeated in 1996 with higher populations of *P. penetrans* in the soil and more severe drought/nutrient stress allowed for the plants. Data for 1996 are currently being analyzed.

Table 1 Total nematodes per pot (from soil and roots) from different *Prunus* rootstocks grown in soil infested with *Pratylenchus penetrans*, 1995

Rootstock	Mean Total Number of *P. pratylenchus* per pot (soil + roots)
BY520-9	81437 a*
GF305	66121 ab
SL4028	65140 ab
Montclar	63405 ab
BY520-8	59480 bc
H7338019	59276 bc
H7338013	56668 bc
SL2243	50327 bc
Higama	41116 c
Tzim Pee Tao	40280 c
Bailey	39229 c
Chui Lum Tao	13761 d

* Values are means of 5 pots per replicate, 4 replicates. Values followed by the same letter are not significantly different according to SNK Multiple Range Test ($P<0.05$).

END OF SECTION L

SECTION M - PEST MANAGEMENT METHODS/MÉTHODES DE LUTTE DIRIGÉE - BIOLOGICAL CONTROL

- Reports/Rapports # 134-136
- Pages # 262-267

Section Editor: **Robert M. Trimble**

PMR REPORT # 134 **SECTION M: BIOLOGICAL CONTROL**
STUDY DATA BASE: 9207

CROP: Apples cv. Liberty/M9
PEST: Western flower thrips, *Frankliniella occidentalis* (Pergande)

NAME AND AGENCY:
COSSENTINE J E, HOGUE E J, and JENSEN L B
Agriculture and Agri-food Canada, Pacific Agri-Food Research Centre,
Summerland, B.C. V0H 1Z0
Tel: (250) 494-7711 **Fax**: (250) 494-0755 **Email**: COSSENTINE@BCRSSU.AGR.CA

TITLE: POTENTIAL OF RELEASED PREDATORS TO CONTROL ESTABLISHMENT OF WESTERN FLOWER THRIPS UNDER THREE ORCHARD FLOOR COVERS

METHODS: The orchard floor of a three and four-year-old Liberty/M9 slender spindle apple orchard was maintained in two replicates of three sections as: 1) completely clean throughout the year with a combination of tillage, contact and residual herbicides; 2) pure grass sod of perennial rye grass and creeping red fescue and maintained free of broadleaf weeds with 2,4-D and mecoprop; and 3) seeded with white clover and a wide assortment of local broadleaf weeds. Tree rows were maintained relatively weed free with regular herbicide applications.

At pink-stage of bud development, four groups of six adjacent trees were tagged within each groundcover and replication. Trees within each groundcover were sampled by limbtaps and western flower thrips counts recorded. Samples were repeated every three to seven days until the end of May (except the week of May 13 when continuous rains made data collected using the above technique incomparable with data from other weeks). On May 13 and 14, when samples indicated western flower thrips were moving into the blossoms, the following releases were made into each tree in each treatment:three commercially reared *Chrysopa carnea* maintained on codling moth eggs and neonates at 15-20°C for 24-39 days (late nymphs); five commercially reared *C. carnea* and released upon arrival (early nymphs); four *Daereocoris brevis*, released upon arrival (adults). The fourth group of six tagged trees was used as the control. Blossom samples of 25 clusters per treatment block per replication were made at pink-stage of bud development and the western flower thrips counted under a dissecting microscope. Fifteen clusters were collected two weeks post release and western flower thrips assessed. All fruit was harvested from each monitored tree June 19 and western flower thrips damage recorded. Treatments were statistically compared, after arcsin transformation of the data, using an ANOVA and means compared using a Duncan's multiple range test.

RESULTS: Samples did not detect more than single western flower thrips per tree before the week of predator release (May 13). The following week, thrips counts were high (Table 1) with no significant difference between groundcovers. Western flower thrips limbtap counts had decreased to 1.3 to 2.1 per tap by the following week. Western flower thrips counts in blossom cluster samples collected May 30 (Table 1) reflected a significant effect of groundcover ($P=0.017$) however there was no significant effect of the predator released ($P=0.493$).

As in 1995, the percent of apples damaged by the western flower thrips was not significantly ($P>0.05$) less from trees with soil (17.3%) or grass groundcover (21.6%) than from trees with weed groundcover (20.5%). However, in the soil block, apples from the *D. brevis* release treatments were significantly ($P<0.05$) less damaged than apples from the control trees (Table 2).

CONCLUSIONS: *D. brevis* released when western flower thrips move into the apple trees (pink to full bloom) may significantly decrease western flower thrips oviposition damage to fruit in orchards with soil groundcover, however damage levels of 13.3% do not justify the predator and soil groundcover as independent western flower thrips control strategies. Cold exposure of *C. carnea* does not appear to improve the predators efficacy versus western flower thrips at May temperatures ranging from 3.5 to 24.5°C, however release rates were not identical in the two treatments (3 and 5/tree for cold treated and normal *C. carnea* respectively). As was observed in 1995, soil or grass groundcovers are not sufficient to act as efficient independent western flower thrips control strategies.

Table 1. Mean western flower thrips per limbtap and cluster samples over time.

Date	Groundcover	Mean thrips per limbtap	Mean thrips per blossom
April 26	soil	0.0	0.04
	grass	0.2	0.04
	weed	0.1	0.04
May 3	soil	0.2	-
	grass	0.2	-
	weed	0.2	-
May 10	soil	0.0	-
	grass	0.1	-
	weed	0.2	-
May 23	soil	7.8	-
	grass	13.6	-
	weed	11.4	-
May 30	soil	2.1	4.0 a[1]
	grass	1.3	5.5 b
	weed	1.3	5.1 b

[1] means followed by the same letter are not significantly ($P>0.05$) different as determined by Duncan's multiple range test.

Table 2. Mean percent apples damaged by western flower within three ground covers and three predator-release treatments (*Chrysopa carnea*, held at 15-20°C; and *C. carnea* and *Daereocoris brevis* both released upon receipt).

Cover	Predator released	% damaged apples (sd)
Soil	*C. carnea* (15-20°C)	15.5 (9.3) ab[1]
	C. carnea	19.2 (8.3) a
	D. brevis	13.3 (10.3) b
	control	21.3 (7.9) a
Grass	*C. carnea* (15-20°C)	27.1 (8.0) a
	C. carnea	21.7 (13.0) ab
	D. brevis	17.0 (13.6) b
	control	20.5 (8.1) ab
Weed	*C. carnea* (15-20°C)	20.2 (14.2) a
	C. carnea	19.5 (12.8) a
	D. brevis	23.2 (15.0) a
	control	18.8 (13.3) a

[1] means within groundcover followed by the same letter are not significantly ($P>0.05$) different as determined by Duncan's multiple range test.

PMR REPORT # 135 SECTION M: PEST MANAGEMENT METHODS - BIOLOGICAL CONTROL
STUDY BASE #: 280-9305

CROP: Various vegetable, fruit and field crops
PEST: Two-spotted spider mites, *Tetranychus urticae* Koch

NAME AND AGENCY:
WHISTLECRAFT, J.W. and VANGRINSVEN, I.
Agriculture and Agri-Food Canada, Pest Management Research Centre
LONDON, Ontario Canada N5V 4T3
Tel: (519) 457-1470 **Fax:** (519) 457-3997 **Email:** whistlecraftj@em.agr.ca

TITLE: PRODUCTION OF A MITE PREDATOR *Stethorus punctillum* IN MICROPLOTS, 1996

METHODS: The test was conducted at the Pest Management Research Centre Farm, London, Ontario, during July, 1996. We seeded twelve microplots, 1/5000 ha in area, with 300 broad bean seeds (Var. English Long Pod from Ontario Seed Company) per plot on June 25 1996. Once seedlings had reached 10 cm. height on July 10, we added *Tetranychus urticae* (Koch) from 35-40 heavily-infested snap bean plants per plot from our laboratory rearing system. All plots were covered at this time with a commercially available row cover to limit contamination by other pests and beneficials. Spider mites were added again on July 15 to hasten the build up of mites in each plot. Thirteen days after the initial mite inoculation, we added either 0,35 or 70 *Stethorus punctillum* adults to microplots in a completely randomized design, replicating each treatment four times. We collected leaf samples from each plot to determine population estimates 1,2,3 and 4 weeks after the addition of predators. Six bean stalks from each microplot were bagged individually, for assessment in the laboratory. We scanned each leaf, top and bottom. Spider mite numbers were recorded only as Present or Absent. Beetle numbers were recorded as total numbers of each lifestage per stalk. Due to the growth of the beans we removed the protective covers on the third sampling date. Reproductive success was determined by the number of offspring reaching the pupal stage. After the last sampling date, all remaining bean plants were counted to enable a population estimate to be calculated.

RESULTS: Cool nights during the inoculation time slowed the population buildup and necessitated a second inoculation of spider mites. The row cover effectively inhibited immigration of native pests and predators during the period of time that the plots remained covered; although larger row covers would have enabled protection for the entire period of the experiment. Maximum increase in total beetle lifestages was observed at Week 3 in Treatment 3(Table 1). Although eggs and larvae were still present in week 4, numbers of prey were decreasing. Little or no more beetle survival to pupation was expected. We therefore terminated the experiment and based the resulting population increase on numbers of pupae per stalk at the time of the final observation. Plant counts made after the termination of the experiment produced an average plant stand of 233.25 +/-9.86 stalks per plot. Therefore, we determined the maximum mean pupal population as 482.8 per plot or a 6.9X increase in population based upon an initial population of 70 beetles per plot. The rate of increase for 35 beetles per plot was 4.5X based on 156.3 pupae per plot.

CONCLUSIONS: The ability to increase predator numbers in these small outdoor microplots could form the basis for re-establishment of the beneficial species in areas close to various orchards or berry fields in an economical fashion.

Table 1. Summary of Predator Populations over Time

Treatment	Mean Numbers* of Total Beetle Lifestages per stalk (SEM)			
	Week1	Week2	Week3	Week4
1 CONTROL	0	0	0	0.13(.07)
2 35 SP	3.83(1.07)	3.92(.96)	3.6(.71)	2.29(.6)
3 70 SP	3.17(1.0)	4.38(1.02)	8.52(1.2)	5.25(1.03)

* Figures represent the means of 6 stalks per plot, 4 reps per treatment

Table 2. Summary of Spider Mite Populations over Time

Treatment	% Plants with T. urticae			
1 Control	100	100	100	75
2 35 SP	100	100	100	50
3 70 SP	100	100	100	75

Table 3. Resulting Pupal Production

Treatment	Mean Numbers* of Beetle Pupae per Stalk (SEM)			
	Week1	Week2	Week3	Week4
1 Control	0	0	0	0
2 35 SP	0	0	.36(.19)	.67(.21)
3 70 SP	0	0	.8 (.41)	2.04(.41)

* Figures represent the means of 6 stalks per plot, 4 reps per treatment.

PMR REPORT # 136 SECTION M: PEST MANAGEMENT METHODS - BIOLOGICAL CONTROL
STUDY DATA BASE: 8909

HOST: Beef cattle
PEST: House fly, *Musca domestica*, and stable fly, *Stomoxys calcitrans.*

NAME AND AGENCY:
FLOATE K D and T J LYSYK
Agriculture and Agri-Food Canada, Lethbridge Research Centre,
P.O. Box 3000, Lethbridge, Alberta T1J 4B1
Tel: (403) 327-4561 **Fax**: (403) 382-3156 **Email**: FLOATEK@EM.AGR.CA

TITLE: COMPETITIVE EXCLUSION OF THE PARASITIC WASP, *MUSCIDIFURAX RAPTORELLUS*, IN MIXED CULTURE WITH *M. RAPTOR* AND WITH *M. ZARAPTOR*

BACKGROUND: Species of *Muscidifurax* wasps are pupal parasitoids of house fly, *Musca domestica*, and stable fly, *Stomoxys calcitrans. Muscidifurax raptor* and *M. zaraptor* are native to Alberta. Both are solitary species, typically producing 1 wasp per host. *Muscidifurax raptorellus* is a non-native species that is gregarious, producing as many as 15 wasps per host. The current study reports on part of an ongoing project to evaluate the benefits of releasing *M. raptorellus* into southern Alberta feedlots for the control of pestiferous flies.

METHODS: To assess its ability to compete with native species of *Muscidifurax*, mixed colonies were initiated of *M. raptorellus* x *M. raptor*, and of *M. raptorellus* x *M. zaraptor.* Each combination was replicated three times, with starting populations of about 500 individuals for each species. House fly pupae were added to colonies every 2-3 days, to provide wasps with a source of food and host pupae. Every 2 weeks, 500 fly pupae were placed in cages for 2 days, then removed and held individually for parasite emergence. Patterns of emergence were used to distinguish among these morphologically-similar species. Pupae producing more than 1 wasp were assumed to be parasitized by *M. raptorellus.* Pupae producing only 1 wasp were assumed to be either *M. raptor* or *M. zaraptor.* Laboratory studies show that *M. raptor and M. zaraptor* only rarely produce more than 1 wasp per host.

RESULTS: *Muscidifurax raptorellus* became nearly extinct in 6 generations in mixed colonies of *M. raptorellus* x *M. raptor*, and of *M. raptorellus* x *M. zaraptor* (Table 1). This result was repeated in each of three replications.

CONCLUSIONS: Results suggest that *M. raptorellus* is unable to compete with *M. raptor* or *M. zaraptor* in laboratory colonies. One immediate implication of this finding is that commercial insectaries rearing several species of *Muscidifurax*, may lose colonies of *M. raptorellus*, if they become contaminated by solitary species of *Muscidifurax.* A switch in species composition within the colony would not likely be detected unless host pupae were held for parasitoid emergence. Results also suggest that establishment of *M. raptorellus* may be inhibited in the field if species of solitary *Muscidifurax* are present. If so, field releases of *M. raptorellus* are unlikely to displace native species of *Muscidifurax.*

Table 1. Performance of *Muscidifurax raptorellus* when reared in competition with *M. raptor*. Values are means (SE) averaged for three replications.

	Estimated composition of colony (%)	
Generation	*M. raptorellus*	*M. raptor*
0	50 (0)	50 (0)
1	24 (7)	76 (7)
2	94 (1)	6 (1)
3	55 (10)	45 (10)
4	16 (3)	84 (3)
5	25 (7)	75 (7)
6	0 (0)	100 (0)
7	0 (0)	100 (0)
8	0 (0.4)	100 (0.4)
9	2 (0.3)	98 (0.3)
10	0 (0)	100 (0)
11	0 (0)	100 (0)

Table 2. Performance of *Muscidifurax raptorellus* when reared in competition with *M. zaraptor*. Values are means (SE) averaged for three replications.

	Estimated composition of colony (%)	
Generation	*M. raptorellus*	*M. zaraptor*
0	50 (0)	50 (0)
1	9 (3)	91 (3)
2	92 (2)	8 (2)
3	79 (5)	21 (5)
4	30 (6)	70 (6)
5	44 (11)	56 (11)
6	7 (7)	93 (7)
7	1 (0.1)	99 (0.1)
8	3 (0.7)	97 (0.7)
9	1 (0.6)	99 (0.6)
10	1 (0.7)	99 (0.7)
11	0 (0)	100 (0)

END OF SECTION M

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PMR REPORT # 137 **SECTI0N E: INSECT PESTS OF ORNAMENTALS AND GREENHOUSE**

CROP: Greenhouse Tomato
PEST: Tomato pinworm, *Keiferia lycopersicella* (Busck))

NAME & AGENCY:
FERGUSON, G M
Ontario Ministry of Agriculture, Food & Rural Affairs, Greenhouse & Processing Crops Research Centre, Harrow, Ontario N0R 1G0
SHIPP, J L
Agriculture & Agri-Food Canada, Greenhouse & Processing Crops Research Centre, Harrow, Ontario N0R 1G0

TITLE: **Evaluation of endosulfan for control of tomato pinworm (*Keiferia lycopersicella*) (Lepidoptera: Gelechiidae)**

MATERIALS: THIODAN 50 WP and THIODAN 4 EC (endosulfan)

METHOD: Several concentrations of THIODAN 50 WP and THIODAN 4 EC were tested for their effects on eggs and adults of *K. lycopersicella*. Concentrations that were tested included 0.33 kg, 0.67 kg, and 1.0 kg of formulated product (Thiodan 50 WP) per 1000 L of water, and 0.31 L, 0.62 L, 0.92 L, 1.0 L, and 1.5 L of formulated product (Thiodan 4 EC) per 1000 L of water. All spray applications were made with a Potter Spray Tower.

To evaluate the effects of Thiodan 50 WP and Thiodan 4 EC on eggs, spray applications were applied to 24-h old eggs laid on greenhouse tomato (cv. Trust) leaves. Each treatment was replicated six times, and each replicate consisted of five eggs. Two ml of each concentration of insecticide solution were applied to each replicate. The control consisted of two replicates of five moths that were sprayed with distilled water. All sprayed eggs were held in petri dishes and maintained at 25ºC and 85% RH in a growth chamber. Eggs were observed for hatching every 24 h, and emerged larvae observed for 48 h after hatching.

Contact and residual toxicities of THIODAN 50 WP and THIODAN 4 EC on adult *K. lycopersicella* were also evaluated. All treatments were replicated six times. To evaluate contact toxicity, two ml of insecticide solution were applied to each replicate of five moths that were previously anaesthetized with carbon dioxide. To evaluate residual toxicity, two ml of insecticide solution were applied to a leaflet which was allowed to dry before placing the anaesthetized moths on the leaflet. There were two control replicates for each of the contact and residual treatments. Distilled water was substituted for insecticide solutions in the control treatments. Diluted honey was provided as a food source for all moths which were held in petri dishes, and maintained at 25°C and 85% RH in a growth chamber. Mortality of moths was observed at 24 and 48 h post treatment.

RESULTS:

Effect of Thiodan 50 WP and Thiodan 4 EC on eggs: Rate of hatching was high (93-100%) in all treatments. However, mortality of the young larvae in all insecticide treatments was high within 48 h after emergence (Tables 1 and 2).

Contact and residual toxicity of Thiodan 50 WP and Thiodan 4 EC to adults: Mortality of adults was high (90-100%) within 48 h of all insecticide treatments, both as a contact insecticide and as a residue (Tables 1 and 2).

CONCLUSION: Thiodan 50 WP and Thiodan 4 EC are effective insecticides for suppressing early larval and adult *K. lycopersicella*.

Table 1. Mortality of young larvae and adults of tomato pinworm (*Keiferia lycopersicella*) following application of Thiodan 50 WP to tomato leaves, and of adults following spray applications to them in a Potter Spray Tower.

Rate of Thiodan 50 WP (kg per 1000 L)	% mortality of hatched larvae on sprayed tomato leaves		% mortality of adults sprayed in Potter Spray Tower (Contact Toxicity)		% mortality of adults placed on sprayed leaves (Residual Toxicity)	
	24-hr old larvae	48-hr old larvae	24 hr after application	48 hr after application	24 hr after initial placement	48 hr after initial placement
0	0	0	0	0	0	0
0.33	63	91	67	93	73	97
0.67	82	100	93	100	80	100
1.0	100	100	97	100	93	100

Table 2. Mortality of young larvae and adults of tomato pinworm (*Keiferia lycopersicella*) following application of Thiodan 4 EC to tomato leaves, and of adults following spray applications to them in a Potter Spray Tower.

Rate of Thiodan 4 EC (L per 1000 L)	% mortality of hatched larvae on sprayed tomato leaves		% mortality of adults sprayed in Potter Spray Tower (Contact Toxicity)		% mortality of adults placed on sprayed leaves (Residual Toxicity)	
	24-hr old larvae	48-hr old larvae	24 hr after applic-ation	48 hr after applic-ation	24 hr after initial placement	48 hr after initial placement
0	0	0	0	0	0	0
0.31	80	93	80	97	57	93
0.62	82	100	80	100	83	100
0.94	100	100	97	100	87	100
1.25	100	100	93	100	93	100
1.50	100	100	100	100	100	100

PMR REPORT # 138 **SECTION K: DISEASES OF ORNAMENTAL, GREENHOUSE AND TURF**

CROP: Greenhouse Tomato, cv. Trust
PEST: Tomato powdery mildew, *Erysiphe orontii*

NAME AND AGENCY:
FERGUSON[1], G.M. and JARVIS[2], W.R.
[1]Ontario Ministry of Agriculture, Food, and Rural Affairs,
Greenhouse and Processing Crops Centre, Harrow, On, N0R 1G0
[2]Agri-Food and Agriculture Canada,
Greenhouse and Processing Crops Centre, Harrow, On, N0R 1G0
Tel: (519)738-2251 **Fax**: (519)738-2929

TITLE: EVALUATION OF FOLIAR APPLICATION OF MICROFINE WETTABLE SULPHUR AND NOVA 40 WP FOR CONTROL OF POWDERY MILDEW (*ERYSIPHE ORONTII*) ON GREENHOUSE TOMATO, 1996 - II

MATERIALS: MICROFINE WETTABLE SULPHUR (sulphur 92% WP); NOVA 40 WP (myclobutanil 40%)

METHODS: This trial was carried out on 12-week old hydroponically-grown tomato plants (cv. Trust). Plants were kept in a glasshouse maintained at 18-22^{0}C and 70% RH. Natural photoperiods for December in southwestern Ontario were maintained. Powdery mildew appeared naturally and uniformly on the plants. Treatments included 7.5 g of MICROFINE WETTABLE SULPHUR (92%) per 10 L, and 0.8 and 1.36 g of NOVA 40 WP per 10 L of water. Each treatment was replicated three times, and each replicate consisted of three plants. Treatments were separated by guard rows. The fungicides were applied with a back-pack sprayer to mildew-infected plants on February 16 and 23, 1996. There was no untreated check because of the risk of undue disease pressure on treatment plots.

Five assessments for disease level were carried out, one pre-treatment assessment on February 15, and four post-treatment assessments on February 22 and 29, and on March 7 and 14. The manual for assessing plant diseases by Clive (1971) was used as a guide during these assessments. Disease level was rated using a scale of 0-5 as described by Spencer (1975). In addition to rating the disease level, the viability of infected spots was evaluated by (a) examining mycelia, conidiophores, and conidia of five leaflets per treatment under the microscope, and (b) by checking the germination of spores smeared onto water agar. Infected leaves collected on February 22, seven days after the first treatment, were used for examination under the microscope, and for spore-germination tests. Germination of spores was checked on February 27 by examining 20 fields for each treatment at 100X magnification.

RESULTS: The results are summarized in Table 1. Reduction in disease levels on plants was observed at seven days following the first treatment. No disease development was apparent during all subsequent post-treatment observations. Microscopic examination of leaflets revealed that mycelia and conidiophores were mainly flattened, and many conidia deflated. Germination of spores from all treatments was very low, 2.2% from the sulphur treatment, 0.3% from the lower concentration of myclobutanil (0.8 g Nova 40 WP per 10L), and 1.1% from the higher concentration of myclobutanil (1.36 g Nova 40 WP per 10 L).

There was slight marginal browning of the leaves on plants treated with sulphur. Subsequent growth on these plants appeared healthy. No phytotoxic effects were visible on plants treated with myclobutanil.

CONCLUSION: All treatments appear to be suitable chemical controls for tomato powdery mildew. This disease was checked within one week following the first application and was suppressed for at least four weeks following the first application of treatments.

References

James, Clive. 1971. A manual of assessment keys for plant diseases. Canada Department of Agriculture No. 1458.

Spencer, D. M. 1977. Standardized methods for the evaluation of fungicides to control cucumber powdery mildew. *In* Crop Protection Agents - Their Biological Evaluation. N. R. McFarlane, ed. London, UK: Academic Press Inc.

Table 1. Mean ratings[1] for infection level of *Erysiphe orontii* on greenhouse tomato, 1996

Date	Microfine Sulphur 92% WP (7.5g/10L)	Nova 40 WP (1.36g/10L)	Nova 40 WP (0.80g/10L)
Feb. 15	2.0	1.1	1.7
Feb. 22	1.0	1.0	1.0
Feb. 29	1.0	1.0	1.0
Mar. 07	1.0	1.0	1.0
Mar. 14	1.0	1.0	1.0

[1] 0-1% of leaf area infected = 1
2-5% of leaf area infected = 2
6-20% of leaf area infected = 3
21-40% of leaf area infected = 4
>40% of leaf area infected = 5

PMR REPORT #139 SECTION K: DISEASES OF ORNAMENTAL, GREENHOUSE AND TURF

CROP: Greenhouse Tomato, cv. Trust
PEST: Tomato powdery mildew, *Erysiphe orontii*

NAME AND AGENCY:

FERGUSON[1], G.M. and JARVIS[2], W.R.
[1]OMAFRA, reenhouse and Processing Crops Research Centre,
Harrow, On, N0R 1G0
[2]Agri-Food and Agriculture Canada, Greenhouse and Processing Crops Centre,
Harrow, On, N0R 1G0 **Tel**: (519)738-2251 **Fax**: (519)738-2929

TITLE: EVALUATION OF FOLIAR APPLICATION OF MICROFINE WETTABLE SULPHUR AND NOVA 40 WP FOR CONTROL OF POWDERY MILDEW (*ERYSIPHE ORONTII*) ON GREENHOUSE TOMATO, 1996 - I

MATERIALS: MICROFINE WETTABLE SULPHUR (sulphur 92% WP); NOVA 40 WP (myclobutanil 40%).

METHODS: Six-week old tomato (cv. Trust) seedlings in 12.5-cm diameter pots were inoculated on December 11, 1995 with tomato powdery mildew. The seedlings were kept in a glasshouse maintained at approximately 21^{0}C and 70% RH. Natural photoperiods for December in southwestern Ontario were maintained. Fungicide treatments were sulphur (7.5 g MICROFINE WETTABLE SULPHUR 92% WP per 10 L) and myclobutanil (1.36 g NOVA 40 WP product per 10 L). Each treatment was replicated six times with one potted plant per replicate.

Ten days after infection of the plants with powdery mildew, the fungicides were applied with a hand-held sprayer. All leaves were sprayed to the point of incipient run-off. Fungicides were applied once (Dec. 21/95) when disease lesions were visible on most plants. Two assessments for powdery mildew infection were carried out, the first at one day pre-treatment (Dec. 20/95), and the second at 14 days post-treatment (Jan. 04/96). The manual for assessment of plant diseases by Clive (1971) was used as a guide during these assessments. Mildew infection was rated using a scale of 0-5 as described by Spencer (1975). All leaves were rated for disease level. The percentage of leaves per plant showing infection was also assessed.

RESULTS: The results are summarized in Table 1. Disease level on the post-treatment observation date was noticeably reduced when compared with the ratings on the pre-treatment date. Observations for phytotoxicity revealed the presence of few, small, brown lesions on the plants treated with sulphur. Such lesions did not appear on any new growth on these plants. No lesions were visible on plants treated with myclobutanil.

CONCLUSIONS: One application of Microfine Wettable Sulphur 92% WP or Nova 40 WP appeared to check the development of *Erysiphe orontii* on potted greenhouse tomato plants within two weeks.

REFERENCES

James, Clive. 1971. A manual of assessment keys for plant diseases. Canada Department of Agriculture Publication No. 1458.

Spencer, D. M. 1977. Standardized methods for the evaluation of fungicides to control cucumber powdery mildew. *In* N. R. McFarlane, ed., Crop Protection Agents - Their Biological Evaluation. London, UK: Academic Press Inc.

Table 1. Mean rating for infection level of *Erysiphe orontii,* and percentage of infected leaves on greenhouse tomato, 1996

Treatment	Disease Rating[1]		% Infected Leaves[2]	
	1 day pre-treatment	10 days post-treatment	1 day pre-treatment	10 days post-treatment
Sulphur	0.7	0.2	40	22

Nova	0.7	0.1	39	15

[1] 0-1% of leaf area infected = 1
2-5% of leaf area infected = 2
6-20% of leaf area infected = 3
21-40% of leaf area infected = 4
>40% of leaf area infected = 5

[2] Percentage of total number of leaves infected with *Erysiphe orontii*

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List 1. PESTICIDE AND CHEMICAL DEFINITIONS

Pesticide/Chemical	**Alternative Name(s)**
1100-1	*Pseudomonas syringae*
ABG-6444	*Bacillus thuringiensis* var. *tenebrionis*
ABG-6445	*Bacillus thuringiensis* var. *tenebrionis*
acephate	ORTHENE
ACROBAT	dimethomorph
ACROBAT MZ	dodémorphe + mancozèbe
ADMIRE	imidacloprid
AGRAL 90	surfactant
AGRICULTURAL STREPTOMYCIN	streptomycin sulphate
ALIETTE	fosetyl-al
AMBUSH	permethrin
APRON	metalaxyl
azinphos-méthyl	GUTHION
azoxystrobin	ICIA 5504
AZTEC	phosetbupirin + cyfluthrin
B8	*Enterobacter aerogenes*
Bacillus thuringiensis var. aizawai plus Lepidopteran active toxins	XENTARI
Bacillus thuringiensis var. *kurstaki*	DIPEL
Bacillus thuringiensis var. *tenebrionis*	ABG-6444, ABG-6445
BAS 480	epoxiconazole
BAS 490	methyl methoxyiminoacetate
BASF 300	SANMITE, pyridaben
BAYTAN	triadimenol
BENLATE	benomyl
benomyl	BENLATE
BOND	adhésif, synthetic latex adjuvant
BRAVO	chlorothalonil
BRAVO ZN	chlorothalonil + zinc
captan	MAESTRO, ORTHOCIDE
CAPTAN	captan
carbaryl	SEVIN
CHEM-COP 53	tribasic copper sulfate
chlorfenapyr	STALKER
chlorothalonil	BRAVO
CLEAN CROP COPPER	tribasic copper sulfate
COMPANION	spreader/sticker, octlphenoxypolyethoxy-(9)-ethanol
CONFIRM	tebufenozide
COPPER	copper from tri-basic copper sulphate
COUNTER	terbufos
cryolite	KRYOCIDE
CURZATE	cymoxanil
CURZATE M12	cymoxanil + mancozèbe
CYGON	dimethoate

CYMBUSH	cypermethrin
cypermethrin	CYMBUSH, TD 2344, RIPCORD, STOCKAID
cyromazine	TRIGARD, GOVERNOR
DACOBRE	chlorothalonil + copperT (experimental) 106
DADS	diallyl disulphide + diallyl sulphide
DECIS	deltamethrin
DELICE POUR-ON	permethrin
DIAZINON	diazinon
diazinon	PROTECTOR
dimethoate	CYGON
dimethomorph	ACROBAT
DIPEL	*Bacillus thuringiensis* var. *kurstaki*
DITHANE	mancozeb, maneb
DIVA	iprodione + chlorothalonil
DIVIDEND	difenconazole
doramectin	avermectin derivative
DPDS	n-propyl disulphide
EASOUT	thiophanate-methyl
ELIMINATOR	diazinon + cypermethrin
EN63	Bacillus subtilis
endosulfan	THIODAN
EXP 60115A	fipronil
EXP 60415A	fipronil
EXP 80038C	iprodione
EXP 80415A	fipronil
EXP 80534A	iprodione + thiram + lindane
EXP 806070A	thiram
fenpropathrin	WF1621
fipronil	EXP80415, REGENT, EXP60115A, EXP 60415A
FIXED COPPER	copper hydroxide
FLUAZINAM	IKF-1216
fludioxonil	MAXIM
fluoaluminate de sodium	KRYOCIDE
FOLICUR	hexaconazole
FOLPAN	folpet
FORCE	tefluthrin
fosetyl-al	ALIETTE
FUNGINEX	triforine
FURADAN	carbofuran
GFU383	experimental
GOVERNOR	cyromazine
GUTHION	azinphos-méthyl
hexaconazole	FOLICUR, PROSEED, TF3770A
IB 11522	chlorothalonil
IB 11925	fluazinam + chlorothalonil
IB 17421	acetimide

ICIA 5504	azoxystrobin
IKF-1216	FLUAZINAM
imidacloprid	ADMIRE, UBI 2667, NTN 33893
IMIDAN	phosmet
INCITE	PBO, piperonyl butoxide
iprodione	EPX 80038C
IVOMEC	ivermectin
KOCIDE	copper hydroxide
KRYOCIDE	fluoaluminate de sodium, cryolite
KUMULUS	sulphur
lambda-cyhalothrin	MATADOR, WF2289, WF2406, WF2407
LATRON	spreader/sticker
LINDANE	lindane
LINTURB	iprodione + thiram + lindane
LONLIFE	citrex liquid + organic acids + deionized water
LORSBAN	chlorpyrifos
MAESTRO	captan
mancozeb	PENNCOZEB, DITHANE, MANZATE
MANKOCIDE	copper hydroxide + metallic copper + mancozeb
MANZATE	mancozeb
MATADOR	lambda-cyhalothrin
MAXIM	fludioxonil
MERTEC	thiabendazole
MERTECT	thiabendazole
metalaxyl	RIDOMIL, APRON
METASYSTOX-R	oxydemeton-methyl
methamidophos	MONITOR
methyl methoxyiminoacetate	BAS 490
metiram	POLYRAM
MONCEREN	pencycuron
MONITOR	methamidophos
myclobutanil	NOVA
NAF 85	Spinosad, *Saccharopolyspora spinosa*
NOVA	myclobutanil
NOVO	formerly FORAY 48B
NOVODOR	endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*
NTN 33893	imidacloprid
OMITE	propargite
ORTHENE	acephate
ORTHOCIDE	captan
oxydemeton-methyl	METASYSTOX-R
PBO	piperonyl butoxide
pencycuron	MONCEREN
PENNCOZEB	mancozeb
permethrin	AMBUSH, POUNCE, DELICE POUR-ON
phosmet	IMIDAN

piperonyl butoxide	PBO
POLYRAM	metiram
POUNCE	permethrin
PREMIERE LITE	thiobendazol + thiram
PREMIERE PLUS	thiobendazol + thiram + lindane
PRO GRO	carbathiin + thiram
propargite	OMITE
PROSEED	hexaconazole
PROTECTOR	diazinon
pyridaben	SANMITE, BASF 300,
RAXIL	tebuconazole
REGENT	fipronil
RH-0611	mancozeb + myclobutanil
RH-2485	experimental
RH-5992	tebufenozide
RH-7281	experimental
RIDOMIL	metalaxyl
RIDOMIL-COPPER	metalaxyl + copper hydroxide
RIDOMIL GOLD-MZ	metalaxyl + mancozeb
RIDOMIL-MZ	metalaxyl + mancozeb
RIPCORD	cypermethrin
RIZOLEX	tolclofos-methyl
RONILAN	vinclozolin
ROVRAL	iprodione
RP3	triticonazole + iprodione
RP4	triticonazole + iprodione
RP5	triticonazole + iprodione
RP6	triticonazole + iprodione
RP9	triticonazole
RPA 400727	triticonazole
RPA 407213	imidazolinone
SANMITE	BASF 300, pyridaben
SEVIN	carbaryl
Smother-Oil	petroleum oil
SPINOSAD	spinosyn, NAF 85, *Saccharopolyspora spinosa*
spinosyn	SPINOSAD
STALKER	chlorfenapyr
STOCKAID	cypermethrin
STREPTOMYCIN 17	streptomycin sulphate
SUPERIOR OIL	acaricidal petroleum oil
SUPERTIN	triphenyltin hydroxide
TATTOO	propamocarbe + chlorothalonil
TD 2343	mancozeb
TD 2344	cypermethrin
tebufenozide	RH-5992, CONFIRM
tefluthrin	FORCE

terbufos	COUNTER
tetrachlorvinphos	STIROFOS
TF3770A	hexaconazole
TF 3794	paclobutrazol
thiabendazole	MERTEC
THIODAN	endosulfan
thiophanate-methyl	EASOUT
thiram	EPX 806070A
THIRAM	thiram
TILT	propiconazole
tolclofos-methyl	RIZOLEX
TOPAS	propiconazole
TOPAZ	propiconazole
triadimenol	BAYTAN
triforine	FUNGINEX
TRIGARD	cyromazine
triphenyltin hydroxide	SUPERTIN
UBI 2051	VITAFLO + carbathiin + thiram
UBI 2092	VITAFLO + carbathiin
UBI 2100	VITAVAX + carbathiin
UBI 2383	BAYTAN + triadimenol
UBI 2454	RH3866
UBI 2584	tebuconazole
UBI 2584	RAXIL + tebuconazole
UBI 2643	thiabendazole
UBI 2667	imidacloprid
vinclozolin	RONILAN
VITAFLO	UBI2051 + carbathiin + thiram
VITAVAX	carbathiin
VYDATE	oxamyl
WF1621	fenpropathrin
WF2289	lambda-cyhalothrin
WF2406	lambda-cyhalothrin
WF2407	lambda-cyhalothrin
XENTARI	*Bacillus thuringiensis var. aizawai* + Lepidopteran
ZIRAM	ziram

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Re: Pest Management Research Report - 1996

The Official Title of the Report

1997. Pest Management Research Report - 1996: Compiled for the Expert Committee on Integrated Pest Management, by Agriculture and Agri-Food Canada, Pest Management Research Centre, London, Ontario, Canada N5V 4T3.
February, 1997. (Published on diskette only).

What is on the diskette?

There are four WordPerfect 5.1 text files on this diskette or with this Email.
96README.1ST (1) contains the title page and **TABLE OF CONTENTS**.
96INSECT.REP(2) contains the entomology sections.
96DISEAS.REP (3) contains the diseases, nematode and the biological control practices sections + Appendix 1 (late submissions)
96INDEX.LIS (4) contains 8 indices* and 2 lists for the 1996 reports:

- Index 1. Crop/Host
- Index 2a,b. Pests (insects and diseases)
- Index 3. Non-target Organisms
- Index 4. Residues
- Index 5. Pest Management and Biological Control Methods
- Index 6. Products
- Index 7. Authors
- Index 8. Establishments

List 1. Alternative names for pest control products and chemical compounds.
List 2. Page numbers and corresponding Report Number.

* Report numbers

To Read the Report The files can be read by any IBM or IBM compatible PC using WordPerfect software. The files have been saved in 5.1. If you use 6.1 your PC will automatically convert the files.

Note: Do not make any changes to the file(s) on the disk when you are reading it. The commands will not have room to process on the disk and you will get an error message when you save the file. You must copy the file(s) to your hard drive before you make any changes.

To Print the Report

To print individual research reports, or the complete version of the report, WordPerfect will automatically reformat the file for your printer. The pitch and margin settings are stored as part of the document and should not be changed.

Note: Files (2 - 4) have continuous page numbers.

Procedures for the 1997 Annual Report will be sent in September, 1997, or contact Stephanie Hilton at the London Pest Management Research Centre. Tel. (519) 457-1470 Ext. 218 or Fax (519) 457-3997. Email: hiltons@em.agr.ca

Sujet : Rapport de recherches sur la lutte dirigée - 1996

Titre officiel du document

1997. Rapport de recherches sur la lutte dirigée - 1996. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3. Février, 1997. (Publié sur disquette).

Instructions pour l'utilisation de la disquette.

Cette disquette contient quatre fichiers de texte WordPerfect 5.1.

96README.1ST (1) contient l'avant-propos et **LA TABLE DES MATIÈRES.**

96INSECT.REP (2) contient les sections d'entomologie.

96DISEAS.REP (3) contient les sections sur les maladies, les nématodes et les pratiques biologiques, et l'appendice.

96INDEX.LIS (4) contient les huit indices et deux listes pour le Rapport de recherche:

1. Hôtes (cultures)
2a,b. Ravageurs (insectes et maladies)
3. Organismes visés
4. Résidus
5. Méthodes de lutte biologique
6. Produits (chimiques)
7. Auteurs
8. Établissements

LISTE 1 contient les produits et les noms vulgaires.

LISTE 2 contient les numéros de page et les numéros de rapport correspondents.

Veuillez noter que les numéros dans la table des matières et les indices correspondent aux numéros de rapport et non pas aux numéros de page.

Pour lire le rapport

On peut lire ces fichiers à l'aide d'un ordinateur personnel IBM ou d'un ordinateur personnel compatible IBM et d'un logiciel WordPerfect. Les fichiers sont sur WordPerfect 5.1. Si vous avez 6.1 votre ordinateur les convertira automatiquement.

Note : Ne faites aucun changement sur le disque quand vous le lisez. Les commandes ne pourront entrer sur le disque et vous aurez un message d'erreur. Vous devez copier les fichiers sur le disque dur avant de faire des changements.

Pour imprimer le rapport

Si vous désirez imprimer des rapports de recherche partiels, ou la version complète du rapport, WordPerfect va automatiquement reformater le fichier selon les valeurs implicites de votre imprimante. Les paramètres pour l'interligne et les marges sont enregistrés comme faisant partie du document et ne devraient pas être modifiés.

Note : À cause des variations d'imprimantes, les fichiers 2 à 4 commencent avec avec les numéros de pages continuelles. On mettre les fichiers ensemble pour faire un document sur le disque dur en suivant l'ordre mentionné ci-haut. On vous enverra les procédures pour l'année 1997 en septembre, 1997 ou s'il-vous-plaît contacter Stephanie Hilton au Centre de recherches sur la lutte antiparasitaire à London.
Tél. (519) 457-1470 Ext. 218 ou Télécopie (519) 457-3997.
Email: hiltons@em.agr.ca

1996 PEST MANAGEMENT RESEARCH REPORT

Compiled for:

THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT

Chairperson: Hugh G. Philip, P.Ag.

by:

Research Branch, Agriculture and Agri-Food Canada
Pest Management Research Centre
London, Ontario
CANADA N5V 4T3

FEBRUARY, 1997

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results, particularly of field trials, amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECIPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Pest Management Regulatory Agency, Health Canada, Room E755, Sir Charles Tupper Building, 2250 Riverside Drive, Ottawa, Ontario, K1A 0K9. Telephone (613) 957-2991.

This year there were 139 reports. The Expert Committe on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universitites, and industry who submitted reports, for without their involvement there would be no report. Our special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to Stephanie Hilton for editorial and computer compilation services.

Suggestions for improving this publication are always welcome. Please send your comments by mail or FAX to the Chairperson of the ECIPM.

RAPPORT DE RECHERCHE EN LUTTE DIRIGÉE 1996

Préparé pour:

LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE

Président : Hugh G. Philip, P.Ag.

par:

Agriculture et Agroalimentaire Canada
Centre des recherches sur la lutte antiparasitaire
London(Ontario)
CANADA N5V 4T3

FÉVRIER 1997

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte anti-parasitaire, en particulier, les études sur la terrain, parmi les chercheurs, l'industrie, les universités, les organismes gouvernementaux et tous ceux qui s'intéressent à la mise au point, à l'homologation et à l'emploi de stratégies antiparasitaires efficaces. L'utilisation de produits de lutte intégrée ou de solutions de rechange est perçue par Le Comité d'experts sur la lutte intégrée (CELI) comme faisant parti intégrante d'une stratégie judicieuse en lutte antiparasitaire. En cas de doute au sujet du statut d'enregistrement d'un produit donné, veuillez consulter Health Canada, Agence de Réglementation de la lutte anti-parasitaire, Sir Charles Tupper Building, Salle E755, 2250 Riverside Drive, Ottawa (Ontario) K1A 0K9. Tel. (613) 957-2991.

Cette année, nous avons donc reçu 139 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et Stephanie Hilton qui ont fourni les services d'édition et de compilation sur ordinateur.

Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées. Veuillez donc envoyer vos commentaires par la poste ou par télécopieur au président du Comité d'experts sur la lutte intégrée.

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